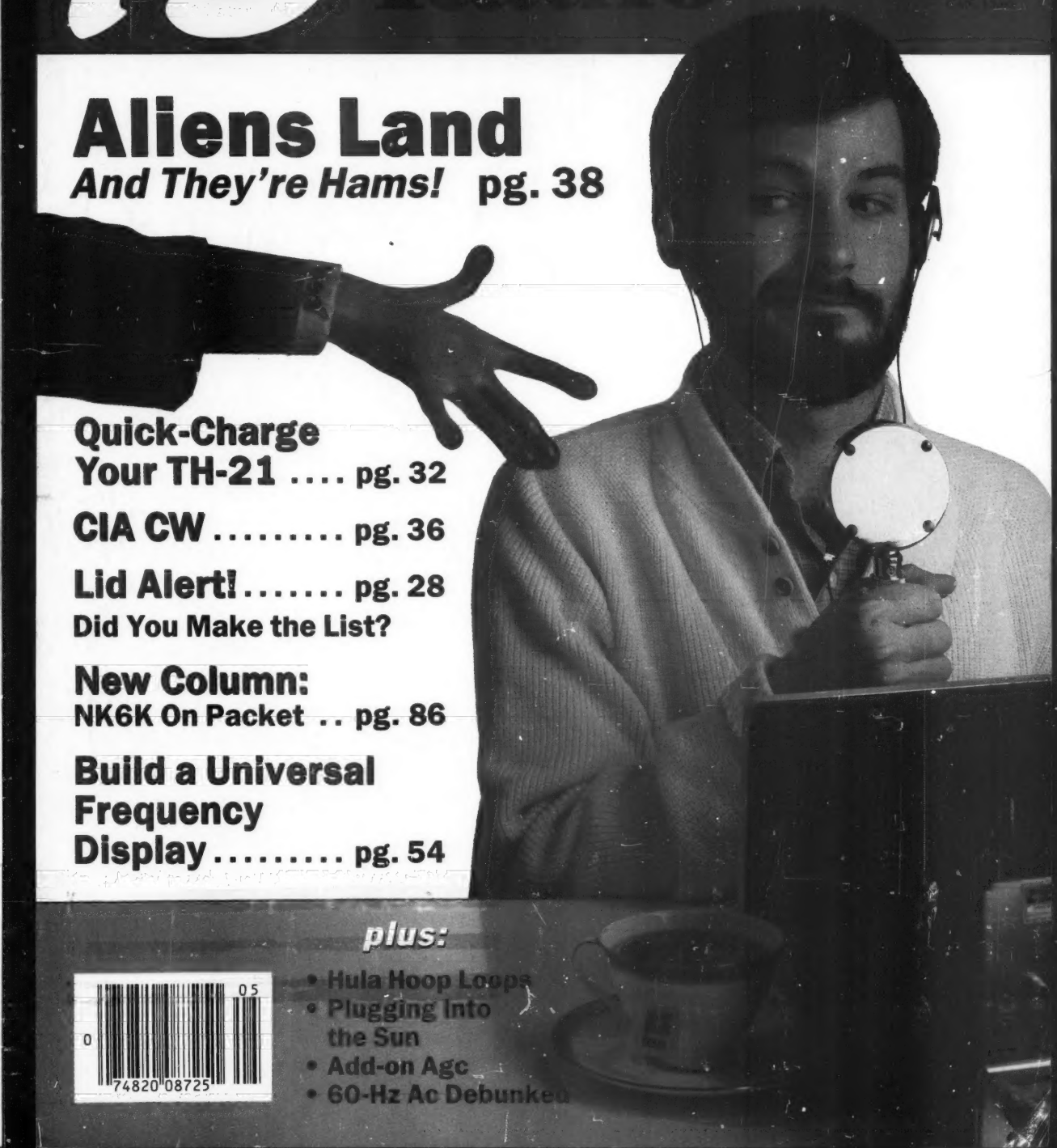
WIN A KENWOOD TM-2570A! (see page 97)

73 Amateur Radio



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Did You Make the List?

New Column:
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Build a Universal Frequency Display ..... **pg. 54**

plus:

- Hula Hoop Loops
- Plugging Into the Sun
- Add-on Agc
- 60-Hz Ac Debunked

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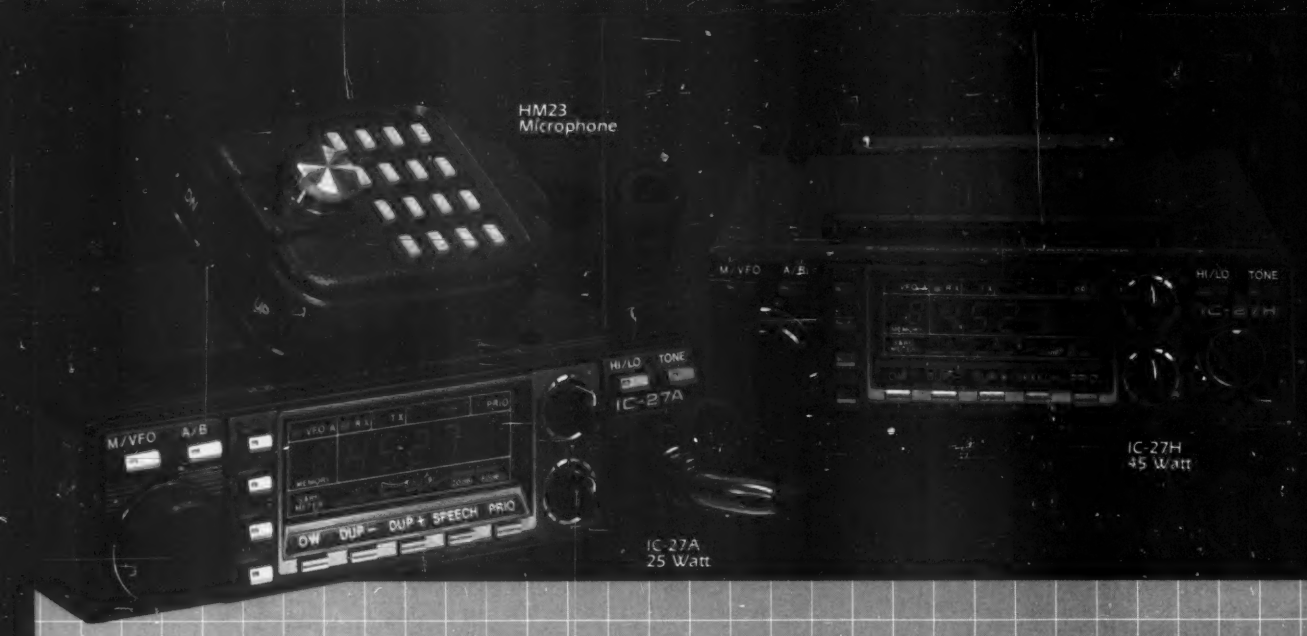
ICOM 2-Meter Mobile

IC-27H



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All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 27H084

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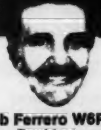

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THINGS TO LOOK FOR *(AND LOOK OUT FOR)* IN A PHONE PATCH

- One year warranty.
- A patch should work with any radio. AM, FM, ACSB, relay switched or synthesized.
- Patch performance should not be dependent on the T/R speed of your radio.
- Your patch should sound just like your home phone.
- There should not be any sampling noises to distract you and rob important syllables. The best phone patches do not use the cheap sampling method. (Did you know that the competition uses VOX rather than sampling in their $1000 commercial model?)
- A patch should disconnect automatically if the number dialed is busy.
- A patch should be flexible. You should be able to use it simplex, repeater aided simplex, or semi-duplex.
- A patch should allow you to manually connect any mobile or HT on your local repeater to the phone system for a fully automatic conversation. Someone may need to report an emergency!
- A patch should not become erratic when the mobile is noisy.
- You should be able to use a power amplifier on your base to extend range.
- You should be able to connect a patch to the MIC and EXT. speaker jack of your radio for a quick and effortless interface.
- You should be able to connect a patch to three points inside your radio (VOL high side, PTT, MIC) so that the patch does not interfere with the use of the radio and the VOL. and SQ. settings do not affect the patch.
- A patch should have MOV lightning protectors.
- Your patch should be made in the USA where consultation and factory service are immediately available. **(Beware of an inferior offshore copy of our former PRIVATE PATCH II.)**

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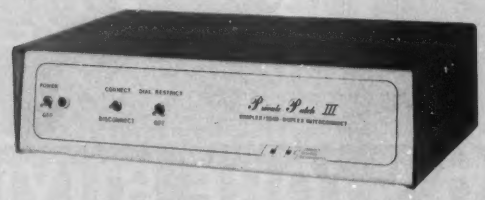
GIVES YOU ALL OF THE ABOVE

PRIVATE PATCH III
SIMPLEX SEMI-DUPLEX INTERCONNECT



The telephone is the most powerful mode of communications . . . PRIVATE PATCH III gives you full use of your home telephone from your mobile and HT radios!

With only three simple connections to your base station radio, PRIVATE PATCH III will give you more communications power per dollar than you ever imagined possible.

Suddenly the utility of your radio is drastically increased. There are new sounds . . . dial tones, ring tones, CW ID and the sound of voices you never expected to hear on your mobile or HT radio! What a convenience!

PRIVATE PATCH III frees you from memberships, cliques and other hassles common to many repeater autopatches. You can call who you want, when you want and for as long as you want. You can even receive your incoming calls!

VOX . . . the right choice!

VOX based phone patches offer many performance and operational advantages over the sampling method. These include operation through repeaters, compatibility with any radio, no lost words or syllables, greater range, smooth audio free of continual noise bursts, etc., etc.

Most amateurs are not aware that the competition's top of the line patch is VOX based. (You know . . . the $1000 model they enthusiastically call **"our favorite commercial simplex patch"** on page 3 of their SP brochure.)

PRIVATE PATCH III offers about the same capability, performance and features as their top model but is priced closer to their bottom of the line (SP) model!

So why settle for SP when top of the line costs little more?

To Learn more about PRIVATE PATCH III and the advantages of the VOX concept, call or write for our four page brochure today!

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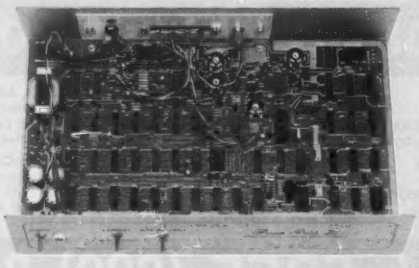
12 VDC or 230 VAC power



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73 Amateur Radio

ISSUE #308 MAY 1986

On the Cover:
Design by Art Director Dianne Ritson. Photography by David Leifer N2ESS. (The alien is on the left.)

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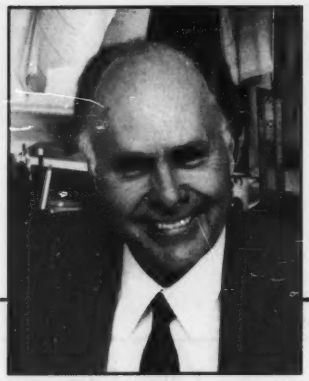
NEVER SAY DIE



THE RIGHT TO LISTEN

If it weren't such an obvious sign of our dumb bureaucracy running amok—giving me even less confidence in congress than I already have left—which isn't much—this craziness over listening to the radio would be one heck of a joke.

Take the million or so people who've bought satellite dishes. For several years now they've been rationalizing their listening to signals intended for cable distribution by telling the rest of us that, what the hell, if the industry doesn't like us buying a system and tuning in to their satellite feeds, why don't they encode them? Fine, I bought that concept.

Now (hold your chair for this one) the satellite dish owners are up in arms, bringing suit against the cable people, trying to force them *not* to encode their transmissions. What kind of nut cases do we have out there? And I certainly don't put down the lawyers who've clustered to fight for this incredibly stupid premise—they're the only ones who can't lose.

Which brings me to the telephone, that revered instrument of confidentiality—the instrument the cellular crowd is trying to make safe for democracy. What a bunch of guano. Firstly, if you know anyone who works for The Phone Company, just ask them about telephone privacy. There *is* no such thing. I've had many telephone people tell me for years that The Phone Company has always made it a practice of listening in randomly to phone calls. Sure, all these people could be lying—and so could the underground telephone newsletters which say the same thing.

Okay, let's say that TPC absolutely doesn't do any such horrid thing. Next in line, unless you've been completely tied up jamming 40-meter service nets for the last few years, is the fact that much of the telephone traffic is sent over microwave links. You also are well aware that Russia has oddly enough set up listening points near many of these links. They have the technology to not just listen in to almost any phone call they want, they could easily record everything and have a computer sort through zillions of calls looking for specific numbers or key words.

How many years have we been using cordless phones? Several. Well, I suppose there are some people who are so dense that they don't realize that every word they say can be heard for a considerable distance by anyone with even the slightest interest—or the willingness to waste his time listening.

So now comes cellular radio and, surprise of surprises, anguish that radio signals aren't private. Gee, who would have ever thought someone could buy a radio and tune in to radio signals? Let's make it illegal to make radios. No, I guess we've got to let 'em make 'em, but maybe we can make it illegal to buy them. How about making it illegal to use them? Sure!

So here we go again, right into a legislative mess far beyond anything the simple congressmen involved ever imagined. Okay now, we've got to prevent people from listening to cordless phones—that means we've got to stop people with broadcast radios from tuning the high end. Perhaps we can make it obligatory that every broadcast radio have a miniature alarm transmitter which would trigger automatically when the dial is turned to the high end, alert-

Continued on page 10

"We're glad you're interested in the apartment! There's one small problem, though . . . a 100-foot tower in the back yard!"

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"DX-cellence!"

TS-940S

The new TS-940S is a serious radio for the serious operator. Superb interference reduction circuits and high dynamic range receiver combine with superior transmitter design to give you no-nonsense, no compromise performance that gets your signals through! The exclusive multi-function LCD sub display graphically illustrates VBT, SSB slope, and other features.

- **100% duty cycle transmitter.** Super efficient cooling system using special air ducting works with the internal heavy-duty power supply to allow continuous transmission at full power output for periods exceeding one hour.
- **High stability, dual digital VFOs.** An optical encoder and the flywheel VFO knob give the TS-940S a positive tuning "feel."
- **Graphic display of operating features.** Exclusive multi-function LCD sub-display panel shows CW VBT, SSB slope tuning, as well as frequency, time, and AT- 940 antenna tuner status.
- **Low distortion transmitter.** Kenwood's unique transmitter design delivers top "quality Kenwood" sound.
- **Keyboard entry frequency selection.** Operating frequencies may be directly entered into the TS-940S without using the VFO knob.
- **QRM-fighting features.** Remove "rotten QRM" with the SSB slope tuning, CW VBT, notch filter, AF tune, and CW pitch controls.
- **Built-in FM, plus SSB, CW, AM, FSK.**
- **Semi or full break-in (QSK) CW.**
- **40 memory channels.** Mode and frequency may be stored in 4 groups of 10 channels each.
- **Programmable scanning.**
- **General coverage receiver.** Tunes from 150 kHz to 30 MHz.
- **1 yr. limited warranty.** Another Kenwood First!

Optional accessories:
• AT-940 full range (160-10m) automatic antenna tuner • SP-940 external speaker with audio filtering • YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filters; YK-88A-1 (6 kHz) AM filter • VS-1 voice synthesizer • SO-1 temperature compensated crystal oscillator • MC-42S UP/DOWN hand mic. • MC-60A, MC-80, MC-85 deluxe base station mics. • PC-1A phone patch • TL- 922A linear amplifier • SM-220 station monitor • BS-8 pan display • SW-200A and SW-2000 SWR and power meters.

25th Anniversary

Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.
Specifications and prices are subject to change without notice or obligation.

More TS-940S information is available from authorized Kenwood dealers.

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NEW Compact 45 W 2 m

45 Affordable Watts!

TM-201B/401B

Super-compact mobile transceivers

The TM-201B boasts a powerful 45 watts output, easy-to-operate front panel controls, and ultra-compact size. The GaAsFET receiver front end provides high sensitivity and wide dynamic range. Receive and transmit characteristics are tailored for minimum distortion and excellent audio quality. Both the TM-201B and the TM-401B are supplied with a high-quality external speaker, 16-key DTMF microphone and mounting bracket.

- 45 watt output, with HI/LO power switch (TM-401B has 25 watts output.)5 W low.
- Dual digital VFOs
  TM-201B covers 142-149 MHz, includes certain MARS and CAP frequencies
  TM-401B covers 440-450 MHz
- 5 memories plus "COM" channel, with lithium battery back-up

- Programmable, multi-function scanning
- High quality external speaker supplied
- Audible beeper confirms operation

Optional accessories:

- PS-430 power supply
- TU-3 or TU-3A two frequency tone encoder
- FC-10 frequency controller
- MC-55 (8-pin) mobile microphone
- SP-40 compact mobile speaker
- SP-50 deluxe mobile speaker
- SW-100A/B SWR/power meters
- SW-200A/B SWR/power meters
- SWT-1 2 m antenna tuner
- SWT-2 70 cm antenna tuner
- PG-2K extra DC cable
- PG-3A DC line noise filter
- MB-201 extra mobile bracket

Optional FC-10 frequency controller
Convenient control keys for frequency UP/DOWN, MHz shift, VFO A/B, and MR (memory recall or change memory channel).

More information on the TM-201B/401B is available from authorized dealers.

25th Anniversary

KENWOOD

TM-401B is similar to the TM-201B, but covers 440-450 MHz and is 25 watts.
Specifications and prices subject to change without notice or obligation.
Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.

TRIO-KENWOOD COMMUNICATIONS
1111 West Walnut Street
Compton, California 90220

QRX . . .

EDITED BY PERRY DONHAM KW1O

Packet Reprieve

THIRD-PARTY TRAFFIC sent via packet radio is legal, at least for the time being. Last month we reported that the Federal Communications Commission had nixed using auto-forwarding systems to transmit third-party traffic. The FCC, in effect deciding that the medium by which a message is sent is not important, stated that a control operator must be present every time a third-party message is passed. The FCC has granted an ARRL Petition for Extraordinary Relief which will allow store-and-forward automatic message handling to continue until a final decision on the matter is made later this summer. Specifically, the waiver allows automatic transmission of third-party traffic using AX.25 (or compatible) protocol on frequencies above 50 MHz. Also, the FCC warns, "Control operators . . . capable of monitoring AX.25 packet transmissions must be alert to the increased dependency upon them for monitoring during the period of this waiver. We call upon them to immediately make known to the responsible control operator of a station retransmitting communications under automatic control any misuse of the station so that the control operator can take prompt corrective action." The FCC will be watching us closely. Our behavior during this waiver will undoubtedly be considered when the commissioners make a final decision on automatic third-party packet systems.

Big Hit

THIS MONTH'S discussion on the **National Teleconference Radio Net** will focus on lightning and power surges. Ed Bellamy and Bill Paulin of Lightning Elimination Associates will host the program. Charlie Kosman WB2NQV will also speak on the upcoming "Hands Across America" project in which six million people will form a living chain stretching from coast to coast. Charlie says that 4,300 hams are needed to coordinate security and safety teams. The NTRN will start at 8 p.m. CDST on May 1, 1986—contact your local repeater guru to find out which machine in your area will be connected.

Harry D. Hooton

***73*'s GOOD FRIEND** and longtime antenna expert,W6TYH, passed away on Christmas Day, at the age of 74. Harry loved antennas and authored numerous articles for *73*. He also wrote the *Single Sideband Book*. In a typical Hooton *73* spectacular, Harry lightheartedly described how he brought down a stubborn wire antenna with a couple of blasts from a 12-gauge shotgun, much to the delight of the crowd of neighborhood children gathered to "help." Despite his poor health in the last few years, Harry continued to "round up the kids" to test antenna designs; when the antennas worked, he sent us the plans. (If they didn't, ka-boom.) In the true ham tradition, Harry's antennas were always a complicated system of pulleys, buckets of sand, and miles of wire set up at precise angles. I'm sure he factored in tree growth, too. We at *73* knew Harry only through his work, but his articles didn't hide his humor and his kind nature. He wrote several of his last articles for us while bedridden, and it is only as his key falls silent that we realize how much we'll miss Harry Hooton.

CIA Maps

IF YOU'RE NOT SATISFIED with what the State Deparment has to say about a country, why not try the CIA? **Phil Spotts** offers a series of color "intelligence" maps which point out geographic features, industries, crops, land utilization, population density, rail lines, roads, airports, and seaports for the nations of the world. The maps are $10 apiece—get in touch with Phil at Best Press Services, PO Box 27073, Phoenix AZ 85061. Send an SASE for a list of available maps.

RFI Update

FROM CANADA come more details on the trial and tribulation of **Jack Ravenscroft VE3SR.** Last year Jack was sued by his neighbors, Tim and Dale Houghtby, who claimed that Jack's amateur radio interfered with their electronic organ and their microwave oven. The Canadian DOC examined Ravenscroft's station and pronounced it "clean." In court, the plaintiffs produced a tape of the interference caused to their organ—and were surprised to learn that the CW had come from VE3OAI, a ham living about 500 feet away from the Houghtbys. Also, the microwave oven that turned on and off of its own accord was fixed when defective components were replaced. Ravenscroft's defense centered around the fact that consumer electronic equipment is simply not immune to rf interference.

Branching Out

FOR YEARS hams have talked about using trees as antennas, and some experiments have shown promising results. Now a West German radiation expert reports that rf can adversely affect trees; he claims that radio waves can decimate forests. The researcher says that leaves, needles, and branches are stressed as they act as mini-antennas, and the stress kills the tree. The foliage also confuses microwave radiation with sunlight, causing the tree to think that the middle of a winter night is the height of a summer day.

TNC Fix

IF YOU OWN a TAPR TNC-2 or an AEA PK-80, listen up. Both of these models use resistor R98 (4.7k Ohms) to provide a software-readable input from the modem. SIO IC U22 provides a pulsed output on the same pin that R98 is connected to; there is a chance that the state machine's operation will be interfered with. To fix this, just replace R98 with a 100k-Ohm resistor.

ACTS Axed

AMSAT'S HOPED-FOR ride into geosynchronous orbit aboard NASA's ACTS satellite is a no-go. It looked as if room aboard the new bird could be made for an OSCAR Phase IV system, but ACTS Program Manager Dan Brandel vetoed the plan because the AMSAT transponder might not be compatible with the ACTS satellite.

Big Bear Base

LOOK FOR KD0DJ/HR3 in Honduras through June. The station, located at base camp Big Bear, near Yoro, is manned by **Chief Warrant Officer Jim Roberson** and **CWO Don Hayes.** The two are on a road-building training exercise, Operation General Terencio Sierra-86, and are attached to the Missouri Army Nation-

CWO Jim Roberson operating KD0DJ/HR3 near Yoro, Honduras.

al Guard. Jim is a UH-1 helicopter pilot with the 135th Engineer Support Group and Don is the Task Force Maintenance Officer for the 203rd Engineer Battalion. The station is operated a few hours per day, mainly for stateside phone patches, on 15, 20, and 75 meters.

Out the Hatch

THE SOVIET UNION has replaced the aged Salyut-7 space station with a new, larger one called Mir (Peace). After an automatic shakedown of the orbiter, the first cosmonauts to occupy the new platform were sent up in a rare, nationally-televised launch. It is very likely that the cosmonauts will manually launch **ISKRA 4,** a small amateur satellite with an uplink and downlink in the HF bands. "Manual launch" means that the satellite will be dumped out through Mir's garbage disposal system. ISKRA 4 will have a low, circular orbit that will rapidly decay. Mir is in an eccentric orbit, 307 by 185 km, and you should be able to see the space station as it orbits the earth. A side note: There have been reports of voice communications from Mir on 143.625 MHz.

F2A Okay

A TEN-METER REPEATER can legally identify itself using F2A, thanks to a recent amendment to section 97.61a of the amateur rules. The FCC also changed other sections of Part 97 to indicate F2A authorization wherever F3E repeaters are allowed. The commission had apparently forgotten to include the mode when new emission charts were drawn up. (If you don't know what all those numbers and letters mean, send for *73*'s Genuine FCC Emission Clarification List—it's free for an SASE sent to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: Emissions.)

No Way, Lee

LEE SHOBLOM K6ADA has been denied his request to use portions of the amateur 440-MHz band for news-gathering. Shoblom had asked that he be allowed to use amateur frequencies and equipment to send ATV pictures from remote locations back to his studio, citing the high cost of commercial gear. The FCC agreed with the ARRL and others that the proposal was contrary to the principles of ham radio.

Gun Jumping

WISHFUL THINKING DEPARTMENT: I jumped the gun last month, reporting that two new Soviet satellites, RS-9 and RS-10, had been successfully launched. The mysterious telemetry on ten meters, thought to be coming from the new birds, has been positively identified as emanating from RS-1. RS-1, which has been useless for amateur communication for several years, occasionally pops to life briefly when its batteries charge up. The two new satellites are still undergoing ground tests and are expected to be launched later this year.

Royal Ham

CONGRATULATIONS to His Majesty King Hussein JY1 of Jordan and Her Majesty Queen Noor JY2NH on the birth of their fourth child, **Her Royal Highness Princess Raya JY2RBH.** Speaking of birthdays, 56 Jordanian hams worked nearly 56,000 stations during an on-the-air celebration in honor of HM King Hussein's 50th. Mohammed Ali Nugrush JY4YJ cranked out around 800 QSOs a day for a total log of 11,600 stations, and was awarded a giant silver trophy for his effort by His Highness Prince Raad Bin Zeid JY2RZ.

UK on Six

NOW THAT SIX METERS is available in the United Kingdom, activity is mushrooming there on 50 MHz. The *RSGB News Bulletin* reports plenty of stations to work, most of them running CW. Other countries with new six-meter privileges include Ireland, where 20 special permits have been issued to Class-A license holders (including EI2W, EI9D, and EI6AS), and Portugal, where CT1WW has a 50-MHz permit and is running 3 Watts.

Beacon Bulletin

A NEW TWO-METER BEACON is now operational in Iceland. TF8VHF is on 144.939 MHz, running 40 Watts to a six-element yagi up about 50 feet. The antenna is pointed roughly east.

World Notes

JIM SACKEY N9ESM sent us an interesting package describing "Background Notes," a publication of the U.S. Department of State. Each Note is a summary of information about a single country, such as geography, government, and economy. A map of the country is also included. About 170 Notes are availble at $1 each ($42 for the entire set), or you may subscribe to the series for $32 per year. (The Notes are updated every two years, and a one-year subscription includes around 60 Notes.) Jim points out that "Background Notes" are a good way to learn more about the countries we contact on the air. You can get more information about this publication by calling the Government Printing Office at (202)-783-3238.

Hamfest Help

CHRIS SULESKE N4LZG writes with help for the weary hamfester who wears his faithful HT on his belt. Concerning the rubber duck antenna: "First, connect two BNC ninety-degree angle adapters together. Attach the male end of this combination to the HT. Attach the female end to the antenna; you now have a pivot which angles the antenna downward over the side of the HT. I find this useful in keeping the duckie out of my armpit." Thanks, Chris.

Bar None

THE BIG WINNER in *73*'s Name That Bar Contest ("Fun!," April, 1986) is **Pete Louzader N1CTV.** Pete sent us not one, not two, but *three* separate Western Union Mailgrams, plus electronic mail via CompuServe! In the first Mailgram, the winning entry, Pete describes the bar and its environs: "The 73 Bar and Restaraunt is located at 73 New Street in the Wall Street area of New York City. New Street runs from Wall Street south to Beaver Street...the street is narrow... about 18 feet curb-to-curb. The sandwich shop [next door] is The Sandwich Genie at 69 New Street. Also in this area are the Drago Shoe Repair Shop, the Silver Stars Deli, and the Beaver Key and Lock Shop." Pete is the Director of Facilities Engineering for Automatic Data Processing, Inc., and wins a one-year subscription to *73* for his sharp eye and dry throat.

NK6K>Packet

A NEW PACKET-RADIO COLUMN premiers in this issue of *73* on page 86. "NK6K>Packet," conducted by **Harold Price NK6K,** will explore current trends in packet radio and serve as a national sounding board for the packet community. Harold's name and call will be familiar to packeteers: He has been a major player in the development of amateur packet radio. In fact, Harold participated in the very first on-the-air contact using AX.25 protocol. He also is one-third of the team which wrote the software for TAPR's TNC-1. Welcome to *73*, Harold!

Read Heard

HEARD ISLAND ODYSSEY, a new book by "*73* International" correspondent Kirsti Jenkins-Smith VK9NL, is now available in the United States. The book chronicles the adventures of the Heard Island DXpedition led by Jim Smith VK9NS. Copies are $12.25 (Ohio residents add 6% sales tax). Contact Ron Pretekin AB8K, 6741 Oak Field Drive, Dayton OH 45415.

QSP

"QRX" comes to you this month courtesy of MSgt. Sheldon Daitch WA4MZZ, *The Shortwave Magazine, The JY Newsletter, Sweden Calling DXers, The RaRa Rag,* and *Amateur Radio News*. Send your news and photographs to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: QRX.

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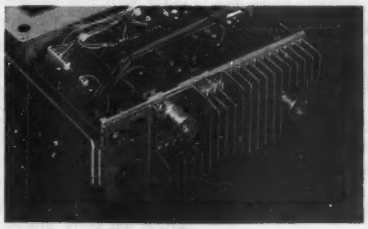
- **Front panel illumination.**
- **10 memories with offset recall and lithium battery backup.**
  Stores frequency, band, and repeater offset. Memory 0 stores receive and transmit frequencies independently for odd repeater offsets, or cross-band (2 m/70 cm) operation.



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  Scans within the chosen 1-MHz segment (i.e., 144.000-144.995 or 440.000-440.995, etc.). The scanning direction may be reversed by pressing either the "UP" or "DOWN" buttons on the microphone.
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- MC-55 8-pin mobile mic. with time-out timer
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- PG-3A noise filter
- MB-4000 extra mounting bracket

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Antenna mag mount is not Kenwood supplied.

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NEVER SAY DIE

from page 4

ing our new Radio Police Force to home in and read the perpetrator his or her rights.

But what about those spies who are tuning into microwave telephone relays? Well, they're going to need a dish or other microwave antenna, so let's make everyone register all microwave antennas. It shouldn't take more than a staff of 50,000 and a budget of $1 billion a year to handle that one. Of course that won't stop the spies because they'll have their antennas within their embassy compounds, beyond the reach of our laws and registration.

Now, what about cellular? Same thing. Let's have every radio capable of tuning those frequencies or being modified to tune those frequencies registered. We'll also have to register the sale of parts because it's so easy to build a small downconverter which would let you tune those frequencies on a low-band rig. I think we'll need a little bigger budget for this one—maybe $5 billion will handle it. But heck, that's no more than the cost of an extra shuttle or three toilet seats for Air Force One.

You know, we haven't even begun. What about the low lifes who are tuning in those new telephones in commercial planes? And the millions of marine telephones? Come *on*, congress—a fine mess you've gotten us into!

CALL THE FCC!

Here's a news flash for you: The FCC is sick and tired of being called every time a ham somewhere gets upset over some terrible thing another ham is doing. Hey, is amateur radio supposed to be self-policing or isn't it? Well, the fact is we're supposed to take care of ourselves and not keep pleading for Big Brother to come in and do an A-Team job on your local jammer . . . or whatever.

In case you haven't a good grasp on the FCC's role in our hobby, let's look at the situation. I find, in my talks with clubs, that many amateurs have a weirdly distorted view of the FCC and its relationship with us.

Try thinking of the FCC as a benevolent bureaucracy—one which has our best interests in mind, but which has both hands and one leg tied by a shortage of funds. It hops around on one leg as best it can to help us out, despite its severe limitations.

The FCC has some very large problems with which it's trying to cope. The whole telephone situation has come unglued as a result of the Bell breakup. Thousands of new firms are fiercely fighting to get pieces of this restructuring, with the FCC having to decide for or against their survival at every turn.

Add to that the increasing legal problems with satellite communications such as the thousands of firms selling earth stations to homeowners on the basis that it's legal for anyone to receive TV signals . . . after all, if the cable people want to keep you from receiving their programs they can encode 'em, right? Now the same bunch is trying to sue the cable people to stop them from encoding their programs on the basis of the investment people have in earth stations.

And so it goes. Communications is up by about two orders of magnitude in the last generation, yet the FCC has been forced to cope with this escalating mess with less and less funds. They need some ham bitching about a repeater jammer or an errant CBer like we need a solar flare radio blackout.

Another thing they really look forward to is the continuous dribble of ill-thought-out petitions for rule changes. These things, which we think are of world importance, are so far down on their scale of priorities that I'm sure there are many people at the FCC who wish we'd just shut up and go away.

The FCC budget cuts have virtually eliminated their monitoring functions, so there's really not much they can do to help us put some jerk ham out of business just because he's causing intentional interference. Heck, I doubt if the entire FCC monitoring division, if brought in from all over the country, could make a dent in our L.A. jamming problem.

Okay, if we're living in a dream world when we think we can turn to Big Brother to fight our fights for us, perhaps it is getting time to adjust to reality and come to grips with it. You know as well as I that we don't need the FCC. There isn't one single thing the FCC is doing right now which we can't do better ourselves, once we face up to it. A whole lot better.

The strength of amateur radio, to my mind, lies in the local amateur radio clubs. As the saying goes, in union there is strength. The excesses of American worker unions has tainted the word union—wherever there is power there will be people anxious to abuse it. That's not currently a problem in amateur radio, but it has been in the past and, mark my words, it will be again.

If we want to improve amateur radio, our best course is to strengthen our club structure. The first step then is to get more hams to join ham clubs so we'll have the club strength we need to be self-policing. Next we can aim at being self-determining, but we can't achieve the second until we've managed the first step.

Club Growth

The big secret in making a ham club a success is both simple and complicated. It goes with—and flies against—human nature. The simple part is the basic rule: If you want to have a successful ham club all you have to do is make it fun to be a member. Oddly enough, most people—and that, to a large degree, includes hams—prefer fun to boredom. People love to get together and lie to each other. Perhaps you've noticed the popularity of parties? Yep, if you pattern your ham club meetings after parties, you're going to have so many members you'll have to find a new place to meet.

There are good parties and bummers, so just making a club meeting more like a party isn't necessarily going to do it. The key to a successful party is making sure that everyone has fun. Now I can give you some guidance toward making your ham club meetings fun, but I want you to try 'em. Afterwards get the members to critique the meeting so you can learn what works and what doesn't work—and perhaps even why. Next, write a letter to *73* telling me what you've discovered—what did and what didn't work. I'll get this into *73* so other clubs can learn from your experience. Together we can build ham clubs which will give amateur radio the strength we need to cope with anything.

As you get to thinking in terms of providing fun, you'll begin to notice that very few members give good marks to business meetings. They just aren't fun. We've managed to lose thousands of ham clubs down through the years, victims of long, boring business meetings. Clubs should, as much as possible, have all club business taken care of by an executive committee. If a member gripes, have him come to the next executive committee meeting—that'll shut him up.

Business meetings are pernicious in that members tend to get deeply involved with them when they're happening, so the club officers may not realize the deadliness of what's happening. The pattern has been repeated over and over—meetings where mem-

Continued on page 76

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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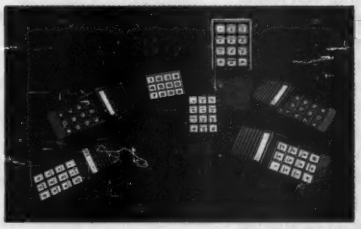

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LETTERS

BUBBLE GUM FUN?

Hear! Hear!

NJ8F, writing in the March issue, hit home dead center! With the average age of hams at 46, I wonder what the average age of a *73* subscriber might be? A few years older, I imagine! I join Staff Stafford in his comment/complaint that the type size was too small for many of your gray-power customers.

I would like to offer a comment/complaint of my own. With the average age of a ham at 46 (I am somewhat older) the "Fun!" feature by KI2U hits far short of the mark. It is written, in my opinion, for a much younger, bubble-gum-chewing audience. The space could be used better for presenting some of Wayne's "finger in the dike" ideas for saving ham radio from itself.

All in good cheer!

Mick McDaniel W6FGE
San Diego CA

We went back to 8-point type (from the too-small 6) in the March issue. (Articles are in 9-point type.) As far as "Fun!" is concerned, over 18% of our readers "read it regularly," and more than a thousand responded to the 1985 KI2U poll (see June issue). No bubble gum was found adhering to any of the responses.—KW1O.

PACKET SOAPBOX

I was a little amazed at the letter on packet radio by Mr. Payne (*73*, December, 1985). I must agree with his indignation at the statements indicating that packet radio will replace other forms of RTTY. It is simply an additional mode, although "packet" has been in use by the military for years. It is with the remainder of his letter that I must take umbrage.

I don't know what magazines Mr. Payne reads or what dealers he talks to, but for some time packet node controllers have been available for less than $200. One manufacturer even has a computer-interface model that does CW/RTTY/AMTOR/ASCII *and* packet. As for the baud rate, most ASCII TTY is 110 to 300 baud. (By the way—nothing is "error-free" if conditions are minimal.)

As concerns satellite communications, a simple set of converters at a 15-W output level will put you on the air for less than $200, not counting antennas (build them yourself). As concerns antennas for satellites, admittedly some have large dishes, but the largest I personally know of is 12 feet. Small yagi arrays (11–22 elements) are much more common. Mr. Payne's example of 12 over 12 (mine is 11 x 11, purchased used for $35) yields an estimated 13-dB gain for approximately 200 erp for a 10-W input—the output of most small rigs and converters without needing an amplifier.

Perhaps before making such disparaging statements, Mr. Payne should do some research on his subject first. He might enjoy the hobby more.

Now that I'm off my soapbox, thanks for a great magazine.

Dean Milner VE1CBF
Sydney, Nova Scotia

My first satellite QSO (through RS-7) was made with an Ameco 2m rig, bought at a hamfest for $20, feeding a 5/8-wave magmount attached to a metal ashtray and propped up on the roof. I just used my dipole for the 10m downlink. Has anyone done it cheaper?—KW1O.

SHORT, SWEET, 'N' SOUR

Joined local radio club as SWL after a mall demo. Took two years for club to decide to have Novice class. During class we had 4 out of 9 students drop out. When I asked older club members to give these people help, the answer was, "Let them do it the hard way like I did." After becoming a Novice and getting on air, no advice, help, inspiration, or whatever was put forth, and if I hadn't gotten POed I would have quit. "Army psychology." By constant prodding of my "peers" Novice instructor stayed after club meeting to help us to upgrade. Eleven months from Novice I made General and other 4 made Tech. Now 2 years later; only one other made General. There have been two Novice classes, as I got students and bugged instructor and with offer to help we had classes. I got candidates for classes in supermarket (baggers), donut shop, and by asking fellows if they would like to be hams and explaining. Two classes started with 15 each and ended with 7 and 2, primarily because instructor was boring and taught *Tune In The World*, your basic Pass-A-Test-But-Learn-And-Understand-Nothing. I wanted to start by first making code oscillator and learning the what, why, and how of components. Of course it would take more time, but it's worth it to create hams instead of machine operators—real hams. Some of our last Novice candidates came from the *73*-inspired "Ham-Day," March 24, 1985, where 4 in club of 50 invited in others. I asked everyone: people in local Post Office, man who gave me lift when I ran out of gas, official at election place, and a couple of Boy Scouts. Made contact with hams on Antigua and Newfoundland so they would help out. Got 4 Novices out of it. Been looking for Ham-Day info for 1986 but have been disappointed and this is what prompted all this. *Why no Ham-Day?*

Last Friday at 6th-Grade Science Fair I demo'd hamming. Asked kids from 4th, 5th, and 6th grades their first names and showed them how in CW. After an average of 3 times they could do it pretty well, so I told them to come back in 10 minutes or so and see if they still could do it. Long story short—got nine young Novice candidates out of four hours. Fun. That's how hard code is.

I criticized QSL Bureau and was told how much work.... I know a General-class op that can't tune his rig if somebody moves controls around. Know one who went from Novice to Extra in 3 months but can't fix his keyer or even try. Takes tests well, though. What I think is wrong with ham radio is the older hams—most of them are not doing their job! They need inspiration or kick in pants.

Walter G. Bastow N4KVF
Gold Hill NC

OK, there's one vote for another Ham-Day. Any others?—Ed.

HE WHO LAUGHS LAST

Welcome back, Wayne! The magazine has missed and needed you. Hope you are able to bring it back to the old rabble-rousing, controversial, yet interesting ham monthly it once was.

Please consider bringing back some features now gone but that I enjoyed in the past—namely, Pasternack's "Looking West," and "Circuits."

I used to laugh at your editorials when you stated that the masses would be using computers soon. Not me, said I. So here I am, using a Commodore 64 and a Speedscript word processor. OK. You were right at least once!

Frank L. Gore K6RTZ
Sierra Madre CA

Look for our old friend WA6ITF in next month's 73.—Ed.

DEAR WAYNE:

Thank God—you're back!

Ben Alabastro WA2PXR
Frankfort NY

WELCOME BACK!

Byron Kretzman W2JTP
Huntington NY

Welcome back! To me, *73 is* Wayne Green. I was sorry to see you leave and am glad to see you back. I won't stop my subscription now!

George Lesch WB2ENP
Staten Island NY

Nice to have you back!

Walter Taylor K2MLT
Hammondsport NY

Thank heaven you are back! Now I'll keep my subscription to *73*.

Merv Simpson WA6YSD
Santa Rosa CA

When you left *73*, so did I—now that you're back, so am I. Wayne, how about giving us the *73* we used to have?

Hal Beebe N6IWI
San Leandro CA

Just watch!—Wayne.

TOOTH & NAIL

Your info about the 40 hams who support K6ADA is totally wrong (*73*, December, 1985, page 7). First off, there aren't 40 hams in the area, and the hams who are in the area will fight tooth

Continued on page 108

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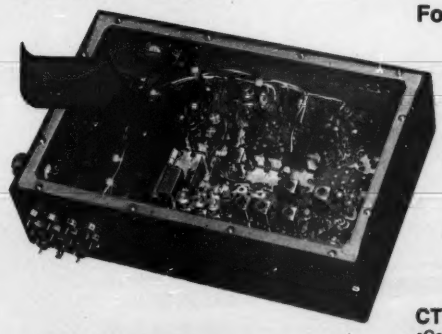

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- Exc. audio quality! Fast squelch! w/0.0005% Crystal. (*"Super Sharp" IF Fltr. also avail.*)

Complete Receiver Assemblies

- Rcvr. Board mounted in shielded housing.
- Completely assembled & tested, w/F.T. caps, SO239 conn.
- As used in the SCR 1000/2000X. Ready to drop into your system!
- UHF Rcvr. Assy. Now Available w/Super Sharp FL-4 Helical Resonators. Greatly reduces IM & "out of band" interference!

FL- 4H

Receiver Front-End Preselectors

- **FL-6: 6HI Q Resonators with Lo-Noise Transistor Amp (2M or 220 MHz)**
- **FL-4H: 4HI Q Helical Resonators & Lo-Noise Tr. Amp. in shielded housing. (420-470 MHz)**
- **Provides tremendous rejection of "out-of-band" signals w/out the usual loss!** Can often be used instead of large expensive cavity filters.
- Extremely helpful at sites with many nearby transmitters to "filter-out" these out-of-band signals.

ID250A CW ID & Audio Mixer Board

- **Improved! Now includes "audio mute" circuit and "Emergency Power" ID option.**
- 4 input • AF Mixer & Local Mic. amp.
- PROM Memory—250 bits/channel.
- Up to 4 different ID channels!
- Many other features. Factory programmed.

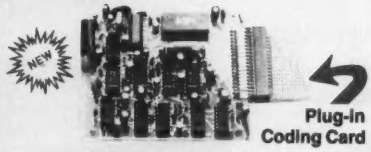
CTC100 Rptr. COR Timer/Control Bd.

- Complete solid state control for rptr. COR "Hang" Timer, "Time-Out" Timer, TX local & remote Shut-down/Reset, etc.
- Includes inputs & outputs for panel controls & lamps.

Repeater Tone & Control Bds.

For SCR1000/4000 & CTC100/ID250 only

- TMR-1 "Kerchunker Killer" or "Time Out Warning Tone" Board
- TRA-1 "Courtesy Tone Beeper" Board



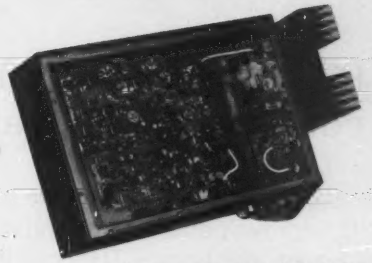
TTC300 TOUCH TONE CONTROLLER

- High performance, Super versatile design. To control any ON/OFF Function at a remote site via DTMF Radio Link.
- Uses new high quality Xtal Controlled Decoder IC, w/high immunity to falsing
- Decodes all 16 digits
- 3 ON/OFF Functions per Main Card. Easily expandable to any no. of functions w/Expansion Cards.
- Codes quickly field programmable via plug-in Coding Cards. Many unique 3-digit codes available. Not basically 1-digit as with competitive units.
- Latched or pulsed outputs.
- Transistor Switch outputs can directly trigger solid state circuitry or relays, etc. for any type of control function.
- Low Power Consumption CMOS Technology. 5VDC Input. Gold-plated connectors.

SCR 500 VHF/UHF COMMERCIAL LINK/CONTROL RECEIVER

- SCR200A or SCR450A rack mounted
- Available with or without meters and power supply

Call or Write for Data Sheets



Improved SCT410B Transmitter Assy.

SCT110 VHF Xmtr/Exciter Board

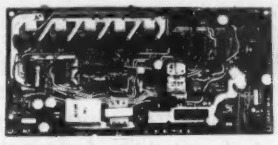
- **10 Wts. Output. 100% Duty Cycle!**
- Withstands High V5WR
- True FM for exc. audio quality
- Designed specificially for continuous rptr. service. Very low in "white noise."
- Spurious −.75 dB. Harmonics −60 dB.
- With .0005% precision grade xtal.
- **BA-30 30 Wt. Amp board & Heat sink,** 3 sec. L.P filter & rel. pwr. sensor.
- **BA75 75 Wt. unit also available**

SCT110 Transmitter Assembly

- ***SCT110 mounted in shielded housing***
- Same as used on SCR 1000 & 2000X
- Completely assmbld. w/F.T. caps, SO239 conn.
- 10, 30, or 75 Wt. unit.

SCT 410B UHF Transmitter Bd. or Assy.

- Similar to SCT110, 10 Wts. nom.
- ***Now includes "on board" proportional Xtal Osc./Oven circuitry for very high stability!***
- **BA-40 40W. U HF AMP. BD. & HEAT SINK**



SCAP Autopatch Board

- Provides all basic autopatch functions
- Secure 3 Digit Access; 1 Aux On-Off function, Audio AGC; Built-in timers; etc. Beautiful Audio!
- 0/1 inhibit bd. also available
- Write/call for details and a data sheet

RPCM Board

- Used w/SCAP board to provide "Reverse Patch" and Land-Line Control of Repeater
- Includes land-line "answering" circuitry

Lightning Arrester For Autopatch

- Gas Discharge Tube shunts phone line surges to ground
- Handles up to 40,000 Amps!
- The Best device available to protect Autopatch equipment from lightning damage. $17.00 + S/H.

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Kantronics "SMARTS"

Presenting three intelligent, versatile, compatible terminal units.

"SMART" means an internal microprocessor is used to improve performance and add versatility. The "Smart" Kantronics TU's can transmit and receive CW/RTTY/ASCII/AMTOR or Packet when combined with your computer and transceiver.

Any computer with a serial RS232 or TTL port can connect directly to a Kantronics TU. A simple terminal program, like one used with a telephone modem, is the only additional program required. Kantronics currently offers Pac-term and UTU Terminal Programs for **IBM, Kaypro, Commodore 64, VIC 20, and TRS-80 Models III, IV, and IVP.** Disk version $19.95. Cartridge $24.95.

UTU The Universal Terminal unit (UTU) is the original "Smart" amateur TU. CW, RTTY, ASCII, and AMTOR can all be worked with this single unit. Switched capacitance filters and LED display tuning make using the UTU easy for even the Novice. 12 Vdc 300mv power supply required. Suggested retail $199.95.

UTU-XT The UTU-XT is an enhanced version of the UTU. Programmable baud rates, tone frequencies, and tone shifts give special versatility. Automatic Gain Control and Threshold Correction circuits greatly enhance sensitivity and selectivity. A RTTY signal detect circuit mutes copy with no carrier, and the CW filter center frequency and bandwidth are programmable. Power supply is provided. Suggested retail $359.95.

NEW!

KPC-2 Kantronics AX.25 **Version 2** TNC features a **built-in HF modem, full duplex** operation, **multiple connects**, and **over 100 software commands**. A serial RS-232 or TTL (C-64/VIC-20) port gives **universal compatibility**. The enhanced generic command structure fits any computer, even PC compatibles. All this combines to make KPC-2 the only TNC you'll ever need. **Suggested retail $219.00.**

For more information contact your local Kantronics dealer or write:

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1202 E. 23rd Street (913) 842-7745
Lawrence, Kansas 66046

A fresh idea!

Our new crop of tone equipment is the freshest thing growing in the encoder/decoder field today. All tones are instantly programmable by setting a dip switch; no counter is required. Frequency accuracy is astonishing ±.1 Hz over all temperature extremes. Multiple tone frequency operation is a snap since the dip switch may be remoted. Our TS-32 encoder/decoder may be programmed for any of the 32 CTCSS tones. The SS-32 encode only model may be programmed for all 32 CTCSS tones plus 19 burst tones, 8 touch-tones, and 5 test tones. And, of course, there's no need to mention our one day delivery and one year warranty.

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SS-32 $29.95, TS-32 $59.95

The TITAN final amplifier may be your final amplifier!

Model 425 TITAN
Linear Power Amplifier

We have been accused of "over designing" the TITAN. And certainly, by cutting corners, it could be built at lower cost. But we think, in the long run, it will be an investment in reliability, flexibility, and the pure enjoyment of a *permanent addition* to your station — long after the price is forgotten.

Every component is chosen to work well below its rating. The power transformer is our own, using a Hypersil® tape wound core, generously designed for excellent regulation. Capacitors and inductors are also made in-house for close quality control.

The TITAN uses two 3CX800 tubes that will loaf along at 1,500 watts output. And, as they require lower plate voltage than older tubes, insulation breakdown is less likely.

We think we have included present and future needs. Things such as full break-in and operation on 160 meters and all authorized bands. A separate power supply makes station layout easy for most convenient operating. And if you use AMTOR, SSTV or RTTY, there is no problem with continuous operation.

The TITAN could easily be your final FINAL AMPLIFIER.

$100 CASH BACK
WITH PURCHASE OF A
TITAN BEGINNING
NOVEMBER 1.

*Commercial version available

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TEN-TEC, INC.
SEVIERVILLE, TENNESSEE 37862

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Find out why on page 97.

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this radio.

Find out why
on page 97.

NEW! Lower Price Scanners

Communications Electronics,™ the world's largest distributor of radio scanners, introduces new lower prices to celebrate our 15th anniversary.

Regency® MX7000-EA

List price $699.95/**CE price $399.95/SPECIAL**
10-Band, 20 Channel • Crystalless • AC/DC
Frequency range: 25-550 MHz. continuous coverage and 800 MHz. to 1.3 GHz. continuous coverage.
The *Regency* MX7000 scanner lets you monitor military, F.B.I., Space Satellites, Police and Fire Departments, Drug Enforcement Agencies, Defense Department, Aeronautical AM band, Aero Navigation Band, Fish & Game, Immigration, Paramedics, Amateur Radio, Justice Department, State Department, plus thousands of other radio frequencies most scanners can't pick up. The *Regency* MX7000 is the perfect scanner for intelligence agencies that need to monitor the new 800 MHz. cellular telephone band. The MX7000, now at a special price from CE.

Regency® Z60-EA

List price $299.95/**CE price $179.95/SPECIAL**
8-Band, 60 Channel • No-crystal scanner
Bands: 30-50, 88-108, 118-136, 144-174, 440-512 MHz.
The *Regency* Z60 covers all the public service bands plus aircraft and FM music for a total of eight bands. The Z60 also features an alarm clock and priority control as well as AC/DC operation. Order today.

Regency® Z45-EA

List price $259.95/**CE price $159.95/SPECIAL**
7-Band, 45 Channel • No-crystal scanner
Bands: 30-50, 118-136, 144-174, 440-512 MHz.
The *Regency* Z45 is very similar to the Z60 model listed above however it does not have the commercial FM broadcast band. The Z45, now at a special price from Communications Electronics.

Regency® RH250B-EA

List price $613.00/**CE price $329.95/SPECIAL**
10 Channel • 25 Watt Transceiver • Priority
The *Regency* RH250B is a ten-channel VHF land mobile transceiver designed to cover any frequency between 150 to 162 MHz. Since this radio is synthesized, no expensive crystals are needed to store up to ten frequencies without battery backup. All radios come with CTCSS tone and scanning capabilities. A monitor and night/day switch is also standard. This transceiver even has a priority function. The RH250 makes an ideal radio for any police or fire department volunteer because of its low cost and high performance. A UHF version of the same radio called the RU150B covers 450-482 MHz. but the cost is $449.95. To get technician programming instructions, order a service manual from CE with your radio system.

NEW! Bearcat® 50XL-EA

List price $199.95/**CE price $114.95/SPECIAL**
10-Band, 10 Channel • Handheld scanner
Bands: 29.7-54, 136-174, 406-512 MHz.
The Uniden Bearcat 50XL is an economical, hand-held scanner with 10 channels covering ten frequency bands. It features a keyboard lock switch to prevent accidental entry and more. Also order part # **BP50** which is a rechargeable battery pack for $14.95, a plug-in wall charger, part # **AD100** for $14.95, a carrying case part # **VC001** for $14.95 and also order optional cigarette lighter cable part # **PS001** for $14.95.

NEW! Regency® XL156-EA

List price $239.95/**CE price $129.95/SPECIAL**
6-Band, 10 Channel • No-crystal Scanner Search • Lockout • Priority • AC/DC
Bands: 30-50, 144-174, 440-512 MHz.
Cover your choice of over 15,000 frequencies on 10 channels at the touch of your finger. Display messages. External speaker jack. Telescoping antenna. External antenna jack. AC/DC.

NEW! Regency® R1060-EA

List price $149.95/**CE price $92.95/SPECIAL**
6-Band, 10 Channel • Crystalless • AC only
Bands: 30-50, 144-174, 440-512 MHz.
Now you can enjoy computerized scanner versatility at a price that's less than some crystal units. The *Regency* R1060 lets you in on all the action of police, fire, weather, and emergency calls. You'll even hear mobile telephones.

Bearcat® DX1000-EA

List price $649.95/**CE price $349.95/SPECIAL**
Frequency range 10 KHz. to 30 MHz.
The *Bearcat* DX1000 shortwave radio makes tuning in London as easy as dialing a phone. It features PLL synthesized accuracy, two time zone 24-hour digital quartz clock and a built-in timer to wake you to your favorite shortwave station. It can be programmed to activate peripheral equipment like a tape recorder to record up to five different broadcasts, any frequency, any mode, while you are asleep or at work. It will receive AM, LSB, USB, CW and FM broadcasts.

There's never been an easier way to hear what the world has to say. With the *Bearcat* DX1000 shortwave receiver, you now have direct access to the world.

NEW! Regency® HX1200-EA

List price $369.95/**CE price $214.95/SPECIAL**
8-Band, 45 Channel • No Crystal scanner Search • Lockout • Priority • Scan delay Sidelit liquid crystal display • EAROM Memory New Direct Channel Access Feature
Bands: 30-50, 118-136, 144-174, 406-420, 440-512 MHz.
The new handheld *Regency* HX1200 scanner is fully keyboard programmable for the ultimate in versatility. You can scan up to 45 channels at the same time including the AM aircraft band. The LCD display is even sidelit for night use. Order **MA-256-EA** rapid charge drop-in battery charger for $84.95 plus $3.00 shipping/handling. Includes wall charger, carrying case, belt clip, flexible antenna and nicad battery.

NEW! Bearcat® 100XL-EA

List price $349.95/**CE price $203.95/SPECIAL**
9-Band, 16 Channel • Priority • Scan Delay Search • Limit • Hold • Lockout • AC/DC
Frequency range: 30-50, 118-174, 406-512 MHz.
The world's first no-crystal handheld scanner now has a LCD channel display with backlight for low light use and aircraft band coverage at the same low price. Size is 1⅜" x 7½" x 2⅜." The *Bearcat* 100XL has wide frequency coverage that includes all public service bands (Low, High, UHF and "T" bands), the AM aircraft band, the 2-meter and 70 cm. amateur bands, *plus* military and federal government frequencies. Wow...what a scanner!

Included in our low CE price is a sturdy carrying case, earphone, battery charger/AC adapter, six AA ni-cad batteries and flexible antenna. Order your scanner now.

Bearcat® 210XW-EA

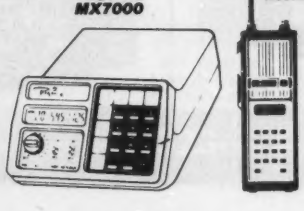
List price $339.95/**CE price $209.95/SPECIAL**
8-Band, 20 Channel • No-crystal scanner Automatic Weather • Search/Scan • AC/DC
Frequency range: 30-50, 136-174, 406-512 MHz.
The new Bearcat 210XW is an advanced third generation scanner with great performance at a low CE price.

NEW! Bearcat® 145XL-EA

List price $179.95/**CE price $102.95/SPECIAL**
10 Band, 16 channel • AC/DC • Instant Weather
Frequency range: 29-54, 136-174, 420-512 MHz.
The *Bearcat* 145XL makes a great first scanner. Its low cost and high performance lets you hear all the action with the touch of a key. Order your scanner from CE today.

TEST ANY SCANNER

Test any scanner purchased from **Communications Electronics**™ for 31 days before you decide to keep it. If for any reason you are not completely satisfied, return it in original condition with all parts in 31 days, for a prompt refund (less shipping/handling charges and rebate credits).



NEW! Bearcat® 800XLT-EA

List price $499.95/**CE price $317.95**
12-Band, 40 Channel • No-crystal scanner Priority control • Search/Scan • AC/DC
Bands: 29-54, 118-174, 406-512, 806-912 MHz.
The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4½" x 12½."

OTHER RADIOS AND ACCESSORIES

Panasonic RF-2600-EA Shortwave receiver $179.95
RD95-EA *Uniden* Remote mount Radar Detector.... $128.95
RD55-EA *Uniden* Visor mount Radar Detector.... $98.95
RD9-EA *Uniden* "Passport" size Radar Detector.... $239.95
BC210XW-EA *Bearcat* 20 channel scanner **SALE**.... $209.95
BC-WA-EA *Bearcat* Weather Alert" $49.95
DX1000-EA *Bearcat* shortwave receiver **SALE**.... $349.95
PC22-EA *Uniden* remote mount CB transceiver.... $99.95
PC55-EA *Uniden* mobile mount CB transceiver.... $59.95
R1060-EA *Regency* 10 channel scanner **SALE**.... $92.95
MX3000-EA *Regency* 30 channel scanner $198.95
XL156-EA *Regency* 10 channel scanner **SALE**.... $129.95
UC102-EA *Regency* VHF 2 ch. 1 Watt transceiver.... $124.95
RH250B-EA *Regency* 10 ch. 25 Watt VHF trans.... $329.95
RH600B-EA *Regency* 10 ch. 60 Watt VHF trans.... $454.95
RU150B-EA *Regency* 10 channel UHF transceiver.... $449.95
RPH410-EA 10 ch. handheld no-crystal trans.... $399.95
LC10-EA Carrying case for RPH410 transceiver.... $34.95
MA181-EA Ni-cad battery pack for RPH410 trans.... $34.95
P1405-EA *Regency* 5 amp regulated power supply.... $69.95
P1412-EA *Regency* 12 amp reg. power supply.... $164.95
BC10-EA Battery charger for *Regency* RPH410.... $84.95
MA256-EA Drop-in charger for HX1000 & HX1200.... $84.95
MA257-EA Cigarette lighter cord for HX1200.... $19.95
MA917-EA Ni-Cad battery pack for HX1200.... $34.95
EC10-EA Programming tool for *Regency* RPH410.... $24.95
SMRH250-EA Service man. for *Regency* RH250.... $24.95
SMRU150-EA Service man. for *Regency* RU150.... $24.95
SMRPH410-EA Service man. for *Regency* RPH410.... $24.95
SMMX7000-EA Svc. man. for MX7000 & MX5000.... $19.95
SMMX3000-EA Service man. for *Regency* MX3000.... $19.95
B-4-EA 1.2 V AAA Ni-Cad batteries (set of four).... $9.95
FB-E-EA Frequency Directory for Eastern U.S.A.... $12.95
FB-W-EA Frequency Directory for Western U.S.A.... $12.95
TSG-EA "Top Secret" Registry of U.S. Govt. Freq.... $14.95
TIC-EA Techniques for Intercepting Comm.... $14.95
RRF-EA Railroad frequency directory.... $10.95
CIE-EA Covert Intelligencl, Elect. Eavesdropping.... $14.95
A60-EA Magnet mount mobile scanner antenna.... $35.00
A70-EA Base station scanner antenna.... $35.00
USAMM-EA Mag mount VHF/UHF ant. w/ 12' cable.... $39.95
USAK-EA ¾" hole mount VHF/UHF ant. w/ 17' cable.... $35.00
USATLM-EA Trunk lip mount VHF/UHF antenna.... $35.00

Add $3.00 shipping for all accessories ordered at the same time.
Add $12.00 shipping per shortwave receiver.
Add $7.00 shipping per scanner and $3.00 per antenna.

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To ***get the fastest delivery from CE*** of any scanner, send or phone your order directly to our Scanner Distribution Center.™ Michigan residents please add 4% sales tax or supply your tax I.D. number. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. Al. sales are subject to availability, acceptance and verification. All sales on accessories are final. Prices, terms and specifications are subject to change without notice. All prices are in U.S. dollars. Out of stock items will be placed on backorder automatically unless CE is instructed differently. A $5.00 additional handling fee will be charged for all orders with a merchandise total under $50.00. Shipments are F.O.B. Ann Arbor, Michigan. No COD's. Most products that we sell have a manufacturer's warranty. Free copies of warranties on these products are available prior to purchase by writing to CE. Non-certified checks require bank clearance.

Mail orders to: Communications Electronics,™ Box 1045, Ann Arbor, Michigan 48106 U.S.A. Add $7.00 per scanner for U.P.S. *ground* shipping and handling in the continental U.S.A. For Canada, Puerto Rico, Hawaii, Alaska, or APO/FPO delivery, shipping charges are three times continental U.S. rates. If you have a Visa or Master Card, you may call and place a credit card order. Order toll-free in the U.S. Dial 800-USA-SCAN. In Canada, order toll-free by calling 800-221-3475. Telex CE anytime, dial 810-223-2422. If you are outside the U.S. or in Michigan dial 313-973-8888. Order today.

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"When You Buy, Say 73"

NEW PRODUCTS

FOX TANGO NEWSLETTER INDEX

Fox Tango Corporation now offers a comprehensive cumulative index to the *FT Newsletter* covering 1976–1985. Articles are grouped by model number (FT-101, FT-757, and so on), and called out by year and page, topic, title, and author.

Both the index ($4 ppd. in the U.S. and Canada, $5 elsewhere) and individual volumes are available from *Fox Tango Corporation, Box 15944, West Palm Beach FL 33411; (305)-683-9587.* Reader service number 154.

SAMS ACQUIRES BOOK LINE

Howard W. Sams, Inc., has acquired the Basic Electricity series of books from Texas Instruments. The series consists of three hardbound books, two lab manuals, and an audio course. The three books are *Basic Electricity and Dc Circuits* ($14.95), *Basic Ac Circuits* ($19.95), and *Basic Electronics Technology* ($19.95). The two lab manuals, *Practical Applications of Dc Theory* and *Practical Applications of Ac Theory*, are available for $12 each.

For more information about these and other Sams books, contact *Howard W. Sams and Company, 4300 West 62nd Street, Indianapolis IN 46268; (800)-428-SAMS.* Reader service number 156.

REGENCY MX-5500 SCANNER

Regency Electronics has announced a 25–550-MHz continuous-coverage scanner. The MX-5500 covers all standard VHF and UHF bands, including four amateur bands (6, 2, 1-1/4, and 3/4 meters). The scanner is preprogrammed at the factory with 20 popular frequencies and is capable of searching through a band for active frequencies.

Designed for home or mobile use, the MX-5500 comes with a telescoping whip antenna, an ac power supply, a dc power cord, and a mobile mounting bracket.

For complete details, contact *Regency Electronics, Inc., 7707 Records Street, Indianapolis IN 46226.* Reader service number 155.

DX HOW-TO FROM TAB BOOKS

DX Power: Effective Techniques for Radio Amateurs is a new book co-published by the American Radio Relay League and Tab Books. Author Eugene Tilton K5RSG gives advice and how-to tips on all facets of DX and DXing, including how to bluff successfully, how to work the DXCC list systematically, and how to stalk rare DX. Tilton explains the special techniques used on the various amateur bands and details leapfrogging, tailending, random calling, and other methods to increase your DXCC total.

For more information, contact *TAB Books, Inc., Blue Ridge Summit PA 17214; (717)-794-2191.* Reader service number 159.

The Regency MX-5500 25–550 MHz scanner.

ICOM ANNOUNCES IC-751A

ICOM has announced a newly designed update of their IC-751. The IC-751A is a 100-Watt HF transceiver with a .1–30-MHz general-coverage receiver. Features include all-mode, 100% duty cycle operation, 12-volt power supply, an electronic keyer, a 500-Hz CW filter, QSK up to 40 wpm, an LED annunciator, and improved noise blanking.

For more information, contact *ICOM America, Inc., PO Box C-90029, Bellevue WA 98009-9029.*

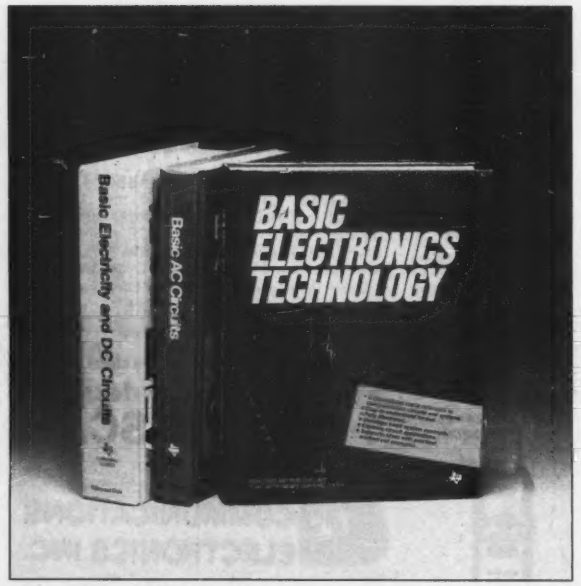
APA PACKET SWITCH

Amateur Packet Alaska has announced the APA VHF/HF Switch, a device which allows any TNC-1 or TNC-2 packet system to be instantly switched from VHF/1200-baud to HF/300-baud operation without retuning or recalibrating. The switch can be activated either manually or by external logic. The switch is housed within the TNC cabinet and takes about an hour to build and install.

The APA VHF/HF Switch is available for $30, and a 15-page nomograph describing VHF/HF switch designs is $3. Please note that APA is an all-volunteer organization and is not equipped to receive telephone or credit card orders. Contact *Amateur Packet Alaska, AX.25 Communications Trail, Ester AK 99725.* Reader service number 160.

WINNER'S EDGE SOFTWARE

Winner's Edge Software has released a new contester's system for the Commodore 64 and 128. Contester II maintains multiplier checklists, dupe sheets, logs, running score, multiplier tallies, and other statistics. The program



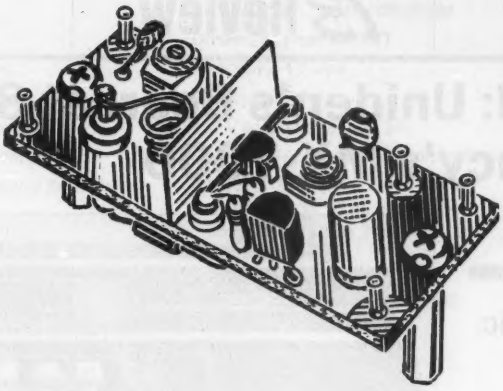
Electronics courseware now available from Sams.

ICOM's new IC-751A HF transceiver.

sends CW, including preprogrammed and user-supplied contest exchanges.

Separate modules expand the basic program's functions to cover specific contests; the ARRL DX Contest module is now available, and modules for the ARRL Sweepstakes and the *CQ* Worldwide DX Contest will be available later this year.

The Contester II requires a Commodore 64 or 128 and one disk drive. A printer is optional. The program is available for $39.95 postpaid from *Winner's Edge Software, 2003 Sarazen Place, Reston VA 22091; (703)-620-3776.* Reader service number 161.



Hamtronics' LNW preamp.

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Head-to-head: Uniden's Bearcat 800XLT versus Regency's MX-7000

by Marc Stern N1BLH

Regency Electronics, Inc.
7707 Records Street
Indianapolis IN 46226
MX-7000: $699.95

Uniden-Bearcat
6345 Castleway Ct.
Indianapolis IN 46250
800XLT: $499.95

The Uniden-Bearcat 800XLT.

When you first look at the Regency MX-7000 and the Uniden-Bearcat 800XLT side by side, an automotive analogy comes to mind. The MX-7000 seems like a rocket-fast Ferrari, while the 800XLT is like a Chevy—basic transportation. Looks as if it's a case of old technology up against the latest in microcomputer-based systems.

Even the boxes give this impression: The Bearcat looks like Bearcats have always looked, while the Regency has a sleek, modern shape with a sloping front, an LCD and a tiny box.

But look again—rather than simply being a case of old versus new, it's more a question of why change for the sake of change? The 800XLT uses the same style of box that has served Uniden-Bearcat for years. It's a practical design that was outlined more than 10 years ago when the first programmable Bearcats appeared and that has been refined ever since. On the whole, it's a much more comfortable design to use.

For example, the 800XLT keyboard angles out from the display area in a way that makes the scanner easy to program. Likewise, the gas fluorescent display is easy to read from about 10 feet away. This visibility has as much to do with the type of display and its brightness as with its viewing angle, which is good.

The Regency MX-7000.

The MX-7000's LCD is visible in most lighting conditions because of the angle of the display, but there are times when ambient light can overwhelm it and cause it to wash out. The display light offers little help because it's too small and doesn't illuminate the display area brightly enough.

Awkward Entry

The MX-7000 is loaded with high-tech goodies and capabilities, but you are forced to handle many of the functions yourself—entering bandwidth, for instance—while in the 800XLT much of the work has been handled in software. For example, if you choose to scan frequencies from 118–136 (the aeronautical service band), the 800XLT automatically selects AM rather than FM. With the MX-7000, you must physically select AM and enter it along with the frequency choice and the memory channel choice, which is rather inconvenient.

In fact, the method of memory entry in the MX-7000 is not only awkward, it's dangerous—it's possible to unintentionally overwrite existing memory information. For example, when you're writing memory information to the MX-7000's scratch pad, you must not only enter the type of modulation technique—narrowband or wideband, FM or AM—but also the bandwidth of the signals you'll be monitoring and the frequency. When this is done, the flag "CH" blinks at you on the LCD as the MX-7000 asks you to store the information in one of its 20 memory locations. So far, this seems pretty straightforward, and it is, but unless you are quick on the membrane keyboard, by the time you're ready to enter this information, you may well have forgotten the channel in which you are storing the information, and you may easily overwrite an existing entry.

This type of mistake is also possible with the 800XLT, but it's a lot less likely to occur because fewer steps are needed to program in a frequency. Again taking the aero band as an example, to program in a frequency you simply manually advance the memory display to an unused channel and enter the frequency followed by the enter key. Since the choice of bandwidth and modulation is handled by the 800XLT's software, it's automatically set up for AM with the correct bandwidth.

Of course, using software to handle these functions does rely on the programmer's microcode assumptions about the appropriateness of a given mode for a given frequency and doesn't take into account regional or local variation. However, by and large, this method works for most of the frequencies in most of the nation.

A unique feature of the MX-7000 is its bandwidth selection. Although it complicates the setup and programming, it gives you the ability to keep distortion to a minimum because of bandwidth problems. For example, if you are listening to an area of the spectrum that uses 5 kHz narrowband FM, you can program the scanner for 5 kHz reception. It offers 12.5 and 25 kHz bandwidth, too. This ensures clean reception of a particular frequency. On some scanners that use fixed bandwidth, it's possible for a conversation to sound distorted because of bandwidth problems. The proper bandwidth also helps ensure a minimum of crosstalk from other frequencies, and it helps the MX-7000 retain its selectivity.

Coverage

The more ambitious of the two scanners in this face-off is the MX-7000. Like the 800XLT, the MX-7000 is microprocessor-controlled and it is capable of covering 25 to 512 MHz continuously, as well as 800 MHz to 1.1 GHz. This contrasts with the 800XLT, which offers coverage in 12 bands from 29 MHz to 912 MHz. Specifically, the 800XLT covers 29.6 to 29.995 MHz; 30 to 50 MHz; 50 to 54 MHz; 118 to 135.975 MHz; 136 to 144 MHz; 144 to 148 MHz; 148 to 174 MHz; 406 to 420 MHz; 420 to 450 MHz; 450 to 470 MHz; 470 to 512 MHz, and 806 to 912 MHz.

You should note that both scanner manufacturers have finally realized that their units are being used by people other than public service radio monitoring enthusiasts. For amateurs, both scanners will cover the FM portion of 10 meters and the entire 6-meter band. Regency, in fact, has broadened the coverage to include frequencies down to 25 MHz so that its scanner can be used by any radio hobbyist.

As recently as five years ago scanner manufacturers assumed the only frequencies anyone was interested in monitoring were the public service band and the marine band. Now, they realize that their units are routinely used by amateurs to monitor favorite repeater or FM frequencies, as well as by other radio hobbyists. I suspect that much of this has to do with the expanded capability of integrated-circuit-based radio receiving technology. But, whatever its basis, it's a welcomed change.

Specifications

	Uniden-Bearcat 800XLT	Regency MX-7000
Size:	10-5/8 by 3-1/2 by 8	5.4 by 3.1 by 7.9 (inches)
Weight:	5 pounds	2.4 pounds
Power:	117 V ac, 20W, 12 V dc, 9W	13.8 V dc
Battery:	Standard 3-volt (alkaline recommended)	
Receive Sensitivity:	0.3 uV 29–54 & 136–174 0.8 uV 118–136, 60 percent, 1 kHz modulation, 12 dB Sinad 0.5 uV 406–512 0.7 uV 806–912 (±3 kHz deviation 12 dB Sinad)	Narrow FM: 1.0 uV (12 dB Sinad) Wide FM: 1.5 uV (12 dB Sinad) AM: 1.5 uV (10 dB S/N)
Receive Selectivity:		NFM ±7.5 kHz at 6 dB WFM ±50 kHz at 6 dB AM ±5 kHz at 6 dB
I-F Selectivity:	-55 dB at ±25 kHz	-50 dB
Frequency coverage:	29–30 MHz 30–50 50–54 118–135.975 136–144 144–148 148–174 406–420 420–450 450–470 470–512 806–912	26–28 MHz 28–50 50–54 54–88 88–108 108–136 136–144 144–148 148–174 174–216 216–220 220–225 225–336 336–406 406–420 420–450 450–470 470–512 800–1.2 GHz
Channel capacity:	40	20
Audio output:	2 Watts, 10 percent THD	1W at 10 percent THD

Scanning and Searching

Continuing the comparison, both the 800XLT and MX-7000 will scan and search, but the MX-7000 offers even more. It will display the time, retain memory without a battery, and allow you to adjust its receive bandwidth. Both units have a priority scan.

In the memory channel department, the 800XLT comes out the winner with 40-channel capability. The MX-7000 offers 20-channel capability. In its start-up mode, the 800XLT scans the first 20 memories. A second bank of 20 is accessed from the 800XLT's keypad.

Programming

It's easy to see that the MX-7000 is for the serious user. Programming it is far more complicated than you would expect, although it doesn't take long to get used to doing it.

To program a memory channel you must first determine the reception mode (narrowband FM, wideband FM, AM). After you've determined this, you press the manual keypad; then press the NFM (WFM or AM) key and enter. You then punch in the frequency and press enter.

At this point you may think you're done, but you're not. Instead, all you've done is programmed the scratch pad memory. You must now put it into permanent storage in dynamic RAM. To do this, you must press "CH" for channel and enter the particular channel you want and then press enter. As you can see, it takes three key sequences to program a channel, which is far from user-friendly.

On the 800XLT, however, you simply determine the frequency you would like to enter, hit the manual key, advance to the memory you want to store it in, enter the frequency, and then hit enter. It takes only one simple key sequence to accomplish this chore.

Memories

Like the MX-7000, the 800XLT uses dynamic RAM memory. Memory retention is another story—the manufacturers have diametrically opposed positions. Regency, manufacturer of the MX-7000, takes advantage of capacitor-backed memory retention. The MX-7000 uses a high-value bleeder resistor to enable the capacitor to retain as much of its charge for as long as possible. This discharge takes about a week, so memories are retained without the need for battery backup.

Uniden-Bearcat uses a more traditional battery backup for its RAM. But rather than using rechargeable NiCds and circuitry to keep them charged, the 800XLT relies on alkaline cells that have higher voltage but that are only good for a few hours to about a day or so because of the voltage requirements of the memory. Uniden should think of implementing some form of long memory storage in this unit.

Keypads and Beeps

It is also quite apparent when you look at the keypad that the 800XLT is far more user-oriented. It uses real push-buttons, rather than the plastic membrane overlay of the MX-7000. The use of push-buttons gives the 800XLT a far more positive feel and makes it easier to enter frequency information.

The MX-7000's membrane keypad is harder to use because it lacks a substantial feel. If

you don't hit a key in the right spot, you won't get the response you expect, a problem endemic to all membrane keyboards. A beep does sound when an entry is made correctly, but it seems that Regency could have used a keypad with real keys to implement programming. Hand-held manufacturers use real pads on their units, which have smaller areas than the MX-7000 has available.

The Rear Deck

On the whole, the rear of the MX-7000 is far busier than the rear of the 800XLT. On the rear of the 800XLT are connectors for 13.8 V dc, ac, ground, antennas, and memory backup batteries. If you look closely at the rear of the 800XLT, you also become aware of something different. Not only is there a connection for an external VHF/UHF antenna, but there is also a connector for an 800-MHz antenna. Unlike the MX-7000, which uses the standard whip antenna or an external antenna for 800 MHz, the 800XLT uses a separate, fixed 800-MHz antenna, which works surprisingly well.

The MX-7000 has an interesting feature that the 800XLT lacks, an attenuator switch on the rear. Switching it on cranks in 10 dB of signal attenuation to prevent receiver overload. It's a nice touch, especially if you're in the near field of a high-powered transmitter. And while this enables your scanner to remain operating, it does have a drawback in that you will only hear the loudest signals. Weak or distant signals won't get through. It's a good idea to use the attenuation only if absolutely necessary. The rear apron also contains the power, antenna, and external speaker connectors.

The MX-7000 is essentially a mobile unit. As such, it requires 13.8 V dc at all times. When running it off 120 V ac, a special step-down transformer is used. The transformer runs cool, and it easily meets the voltage and current requirements of the scanner. It uses a special triaxial power plug. So, if you're going to use 13.8 V dc you'll have to remember to wire a plug to work correctly.

A nice feature of the MX-7000 is its antenna connector. Rather than using a Motorola-type plug, Regency has used a low-loss BNC connector. The 800XLT uses two Motorola-type connectors.

Performance

The 800XLT turned out to be a good, all-around performer during evaluation. Because of the location of the test site—a hilltop about 335 feet above sea level with a clear shot to the horizon—I was easily able to hear stations up to 35 miles away using the telescoping antenna that came with the scanner.

The 800-MHz stub worked quite well, too, even inside a metal-framed building. The 800XLT is fairly free of birdies. As in other Uniden-Bearcat scanners I've used and evaluated, the birdies were primarily evident in the 40–50-MHz range, as well as the 150–160 range. However, they only appeared on widely scattered frequencies and were no problem.

The MX-7000 was also fairly free of birdies, although it was prone to intermod products in the presence of moderate rf, something to be aware of if you're planning to use it in your shack. The 800XLT was also somewhat prone to intermod.

Specifications

The 800XLT has some good specifications and its performance rivaled them. For example, its sensitivity is 0.3 microvolts from 29 to 54 and 136 to 174 MHz. From 118 to 136—the AM aircraft band—it is 0.8 microvolts at 1-kHz modulation for 12 dB Sinad. From 406 to 512 MHz it has a sensitivity of 0.5 microvolts and from 806 to 912 MHz it has 0.7-microvolt sensitivity with 3-kHz deviation at 12 dB Sinad. Intermediate frequency selectivity is -55 dB at ± 25 kHz.

The MX-7000's specifications were also more than reasonable. For starters, it scans continuously from 25 to 512 MHz and from 800 MHz to 1.2 GHz. It was also one of the first scanners on the market to cover the microwave region of the radio spectrum.

Receive sensitivity is 1.0 uV for 12 dB Sinad on the narrowband FM setting and 1.5 uV for 12 dB Sinad on the wideband FM setting. On AM, the sensitivity is 1.5 uV for a 10 dB S/N.

Receive selectivity is 7.5 kHz at the 6 dB point for NFM; 50 kHz at 6 dB for WFM, and 5 kHz at 6 dB for AM.

Image and spurious rejection is better than -50 dB, while intermodulation rejection is better than 50 dB.

Both scanners are equally capable in the audio department, delivering about 1 to 2 Watts of audio with little or no distortion. This is more than enough for any environment.

As you can see, both sets of specifications are very good, although the 800XLT is hotter than the MX-7000, as the figures show.

Both instruction manuals were clear and concise. They were clearly written and will easily lead anyone through the setup and use of each scanner.

Money Matters

The most serious consideration to be made here, though, is the list price of the MX-7000. At nearly $700, frankly it's too expensive for the casual listener, especially when you consider the $499.95 suggested list of the 800XLT. It is hard to justify spending $699.95 for a receiver when that's nearly the price of a good, mobile HF transceiver that offers more capability for the money. It's also hard to justify that amount of money when others also offer comparable units for less money. However, the final choice is still up to the buyer, and if you're determined to have an MX-7000, you should be able to shop around and find discounts in the vicinity of $250. Still, that's a steep price to pay for a complicated unit.

Reader service numbers: Regency MX-7000: 150, Uniden-Bearcat 800XLT: 151.

Heathkit Dual-Trace Oscilloscope

by Paul M. Danzer

Heath Company
Dept. 011-402
Benton Harbor MI 49022
IO-4225 oscilloscope:
$499

The first thing I noticed when I picked up my new Heathkit oscilloscope kit was that it weighed about 30 pounds, including about 10 pounds of carton and shipping material. Quite a contrast to the 75 or so pounds of my soon-to-be retired Tektronix 545.

Make no mistake about it. For a catalog price of $499 (and no surcharge at the Heath retail store) the model IO-4225 is a fully professional instrument meeting the specifications shown in the box—when properly aligned.

My first clue to the complexity of the kit was uncovered as soon as I opened the carton. In addition to the inevitable set of correction sheets to the manuals, there was an additional piece of paper which turned out to be a directory for the shipping carton. This very handy little slip of paper told me where to find the various paper bags of components. The fact that a directory was needed should give you the clue as to how many parts there are.

Construction

Heath sorted out most small components into four packages—numbers 1, 2, 3, and a "final" package. I used two 12 x 16 aluminum-foil baking dishes, with the components of the "final" pack in one dish and one numbered package in the other dish.

Most of the small components come sorted out in order, mounted between two pieces of paper tape. For the initial part of constructing each of the three major boards, each component in turn is taken off the paper tape and inserted in the board. Those who remember assembling early kits will be happy to note that most of the resistors and capacitors are disposed of in this way, leaving few to be identified by hand (and eye). This is fortunate since on the tiny resistors the color code seems to change color when painted upon a brown-body resistor.

Heath sections each board, and construction (or "parts stuffing") proceeds generally from the left section of the board to the right, thus making life a little easier on you. But don't forget: This is not a kit for shaking hands. I found a clear head, a good light, and a magnifying glass (thoughtfully supplied by Heath) absolute necessities. Tiny connector pins designed for automatic machine insertion turn out to be a problem when approached with a pair of hands and long-nose pliers.

I found only one error in the assembly man-

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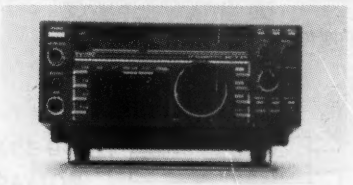

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Power Range	Frequency Bands (MHz) 1.8-30	25-60	50-125	100-250	200-500	400-1000
5 watts	–	5A	5B	5C	5D	5E
10 watts	–	10A	10B	10C	10D	10E
25 watts	–	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
2500 watts	2500H					
5000 watts	5000H					

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ual. Most embarrassingly for someone at Heath, the error occurs on a correction sheet. An old error is corrected but a new error is made—the instruction step to install R520 is missed.

As you would expect from Heath, all of the holes are drilled in the right places and all of the screws fit, but when you try to wire the horizontal section front panel onto the horizontal circuit board, you probably will find your fingers don't fit.

Test and Alignment

Frankly, I was disappointed in the test and alignment section. The old ohmmeter procedure, carried over from the vacuum-tube kit days, is probably OK if Heath would specify clearly where the positive and negative ohmmeter leads (or the ohmmeter lead with positive voltage on it or the lead with negative voltage on it) go for each measurement. Using an ohmmeter to test wires with semiconductors attached, where the ohmmeter sees the semiconductor junctions, turned out to be a rather hit-and-miss procedure.

The greatest disappointment, however, was with the alignment procedure. Nowhere in the catalog did Heath say you would need precision timebase and voltage-calibration equipment, and those of us used to the old Heathkits which contained built-in test sources are in for a rude shock.

In a telephone conversation with a Heath technician, I was told that there were a few complaints about it but they felt people would use common sense and that the customer would realize that high-quality test equipment would be needed to align a high-quality scope. I guess I am guilty; my common sense, based on prior kits, apparently failed me.

Actually, with a 1-kHz square-wave generator, a variable rf and audio generator, and a good counter a pretty fair alignment can be carried out. The process has to be carried out several times in a row. I found, not to my surprise, that the vertical channels are in fact wideband, high-gain amplifiers which before alignment verge on instability, producing very high-frequency sine waves on the trace seen on the screen. After alignment, all signs of instability seem to disappear.

Circuit Description

As you can see from the block diagram (Fig. 1), a dual-channel wideband amplifier provides a choice of either channel 1, channel 2, or chopped (both). A rather complex attenuator section feeding several gain stages provides an input capability ranging from millivolts to volts.

The horizontal channel provides a choice of a standard sweep ("A" timebase) or a delayed sweep ("B" timebase). The operation of the "B" timebase is outlined in Fig. 2. When you set the "A" timebase, the ramp voltage which provides the linear "A" sweep is compared against a dc voltage set by the time-delay-position control on the front panel.

When these two voltages are instantaneously equal, the circuit says "OK, now I'll start the 'B' sweep." If the sweep-mode control is in the "A x B" position, the length of the "B" sweep intensifies the baseline of the "A" sweep so that you know where you are and what will be shown when you change the sweep mode to "B Delay." When you do change to the "B Delay" position, the "B" sweep is now used, and it starts where you previously set it with the delay control.

Sweep trigger can be selected from an external source or either vertical. Although I have not tried it, it appears that since the sweep selection is independent of the channel selected for display, you can display one channel and use the second as a high-gain sweep-trigger amplifier—a very handy trick indeed.

A few other goodies are provided including a standard TV-sync separator for use in TV troubleshooting, a component tester, and a probe-calibrate voltage for setting probe risetime.

The Heathkit 25-MHz dual-trace oscilloscope.

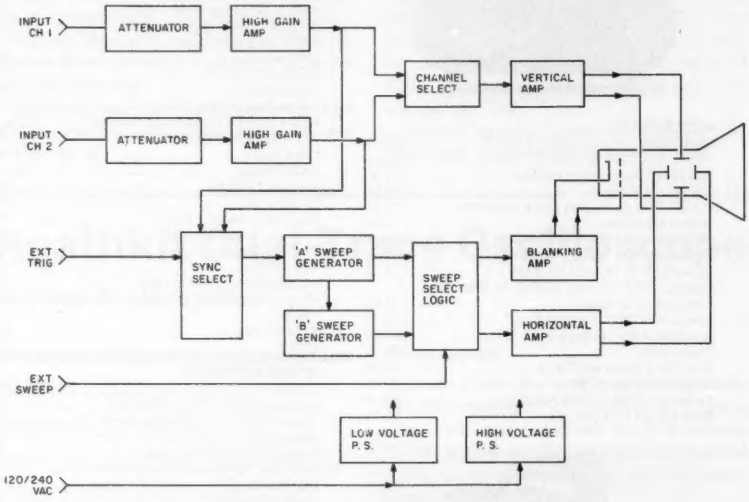

Fig. 1. Block diagram.

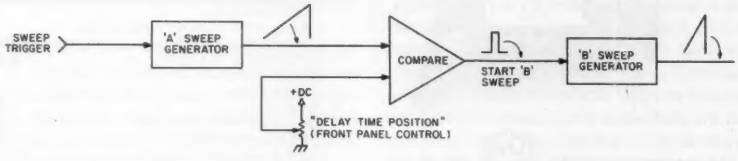

Fig. 2. Delay-sweep generation.

Manuals

As usual, Heath provides a full set of manuals for construction and operation. The manuals are new, have a few bugs, and some strange things are done. As an example, the

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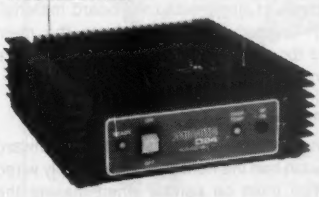

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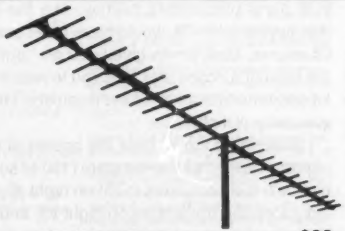

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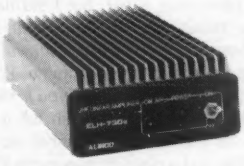

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pictorials showing the controls for alignment are not labeled as to which board is which pictorial, a problem you can rectify with a few strokes of a pen. Other errors did not seem to affect anything since the step-by-step assembly instructions are correct (except for the missing resistor mentioned before).

The circuit-description section of the manual is written clearly, but be prepared to deal with such terms as "cascode amplifiers" and "bootstrap" circuits.

Specifications

Vertical
Dual channel
5 mV/cm to 10 V/cm
3% to 5% accuracy
Dc to 25 MHz
16 nS rise time
1 megohm + 32 pF input
400 V max input (peak)

Sweep Trigger
Select:
- Either vertical channel
- External
- Ac line

Modes:
- Ac
- Dc
- TV vertical
- TV horizontal

Horizontal
Modes:
- A sweep
- B sweep
- X—Y
- External

100 mS to 0.1 microsec/cm
3% to 5% accuracy
5X magnifier
External sweep:
- 0.1 V/cm
- 1 megohm + 40 pF

Other
8 cm x 10 cm CRT
20 lbs
6" (H) x 12" (W) x 20" (D)
120 V ac or 240 V ac

Good and Bad

Unquestionably, for about 500 bucks you get a quality instrument; is this kit for you? As far as I could test, using an old Tektronix and a newer Tektronix clone as a reference, the kit lives up to the published standards. Construction is not easy, and good vision, nimble fingers, and at least average color discrimination are needed.

Circuit design seems quite clean and straightforward except for a few cute tricks, such as in the attenuators of the vertical channels. I was surprised how few dual devices and integrated circuits were used—most of the design uses discrete transistors and FETs.

After alignment and realignment, stability appeared acceptable, and the little things such as lack of jumping from range to range as you switched vertical scales seemed to be taken care of. The horizontal trigger system worked as advertised, and was a great improvement over my old Tektronix.

If you get the Heathkit IO–4225, plan to spend from $60 to $140 dollars more than the cost shown in the catalog. A minimal scope calibrator, needed for alignment and calibration, costs about $60. Without alignment and calibration, you might as well stick to an old uncalibrated scope. Good probes also are needed if you want to take advantage of the scope rise time and use it for looking at those digital circuits on the bench. Without the probes ($30 to $40 each) you will waste your money on this scope.

My own evaluation: Since I plan to keep this instrument for a long time, the ability to service it myself and get repair parts without canvassing all of the Japanese parts distributors by long distance phone is important. As compared to brand name alternative scopes (and only brand name units), the Heath machine will cost you a few bucks less—or you get a few more features for about the same money. The "fun factor" in building it yourself? Given the size of the kit and its complexity and parts density, this one is either more fun than usual or a bit too much—it's up to you to decide.

Reader service number 152.

DSE Commander VHF FM Transceiver

by Peter H. Putman KT2B

Dick Smith Electronics
390 Convention Way
Redwood City CA 94063
Price class: $150

Got the old kit-building itch? Yearn for the smell of solder? Burnt rosin on your fingertips? Or the many hours spent squinting through a magnifying glass looking for solder bridges? Think of it: when was the last time you built a kit that was really fun?

I don't remember either, but I did have a great time assembling the Dick Smith Electronics Commander VHF FM transceiver—it's a good way to spend a few hours (well, 10 or more). When you're all done, you'll have a 10-Watt synthesized FM rig with full 4-MHz coverage. No memories, no scanner, no bells and whistles, just a plain old two-meter FM rig along the lines of the old ICOM IC-22/22S/22U. With a few qualifications, it works well and is easy to tune up.

Assembly

The write-up of the Commander appeared in the August and September 1985 issues of 73, so I won't elaborate here on its technical specs and performance claims. What I would like to do is address the process of building the kit and aligning it afterwards, as well as a few minor problems and one major problem I found with the unit.

As the kit came from DSE, all of the parts were neatly sorted into various bags. A quick check against the parts list revealed one too many resistors and one too few capacitors—items that were in my well-stocked junkbox. I found individual parts overlays helpful in identifying parts placement, although an all-inclusive parts placements overlay, like the one that appeared in 73, would have been useful. Of course, Dick Smith gives you an "out" in the form of a notice that tells you to return the kit unopened for a full refund if you don't think you can pull it off.

I assembled the kit over the course of four nights: I tackled all the resistors (150 or so) on night #1, the capacitors (175) on night #2, the inductors and transistors on night #3, and the balance of parts and cabinet on night #4—a total of about 10 hours, or 2-1/2 hours per night. This made for a nice work pace. One minor problem I encountered, which I talked to DSE about, is the substitution of capacitors, where physically smaller ceramic capacitors have been substituted for larger disc capacitors. This is all well and good, except when the drilled holes for the larger capacitor won't accommodate the smaller one. Some of these low-voltage ceramics actually break in half when stretched too far, so I do consider this a drawback. Either extra holes need to be drilled, or the correct capacitors must be supplied.

Another problem arose momentarily when it came time to install the front and rear panels with respect to the PC board. The panels actually have to be installed upside down—that is, when holding the unit so that the front panel reads correctly right side up, the bottom of the PC board faces up. This is mentioned nowhere in the literature, but the few minutes I spent studying the placement of the thumbwheel switch with relation to the speaker solved the problem. The front and rear panels are made of single-sided PC-board material, which is easily tack-soldered to the main board for extra strength (not to mention the ground contact for both panels!).

Alignment

Despite these problems, I plowed onward and soon had the front panel completely wired up. You must be careful when making the connections to the thumbwheel switch not to bend the wire too much, as DSE supplies telephone wire for these connections. This type of wire is a bit stiff and really doesn't lend itself well to this type of use. A better choice would have been ribbon cable, preferably multi-col-

ored. This flexible cable sustains bending a lot better. I suggest you use wire ties to group the various clusters of wire whenever possible, especially the power leads and volume/squelch control leads from the front panel.

Make sure you solder the ground return from the speaker output jack to the back plane. Don't depend on the barrel of the jack to make contact, as the hole it goes through isn't plated. I missed this and spent 15 minutes wondering why there was no audio output from the speaker! I also substituted a standard Amphenol SO-239 jack for the one supplied. The Amphenol didn't protrude as far over the circuit board as the supplied jack and made a shorter connection to the rf OUT/ANT connection possible.

Finally, I had the unit completely assembled. After applying power, I immediately heard a strong local repeater on 146.985 MHz and used it for the balance of the alignment. DSE says you will need a multi-meter, frequency counter, or 2m FM rig, a dummy load (or 50-Ohm antenna if you can't find one) and a 5-MHz oscilloscope or shortwave receiver. Frankly, all you really need is the multi-meter (preferably a FETVOM or VTVM) and counter.

The alignment procedure is easy. The built-in S-meter allows peaking the front end in short order. The other coils that align the vco, offset oscillators, and PLL are quite broad. The counter expedites the reference frequency calibration, and you could almost align the +5 kHz switch by ear. This part of the procedure went quickly. The problems arose when I tried to align the transmitter, which exhibited wild fluctuations in output power that I couldn't tame. The problem turned out to be the vco buffer amplifier, and a quick fix by DSE returned the unit in fine working order.

Few Complaints

In actual use, the receiver is quite sensitive. DSE claims the selectivity to be better than 60 dB ± 25 kHz, which actually is pretty broad. Most commercially made FM rigs exhibit better selectivity figures, and whether this will be a problem for you depends on the density of 2m repeaters in your area, as well as channel spacing.

Where I live in northern New Jersey, I'm in close proximity to about 75 different repeaters. The standard here is 15 kHz channel spacing, and it's enough of a problem even with fairly tight receivers! So I wasn't at all surprised to see signals from 146.79 sneaking in at 146.805, or 147.000 leaking through at 146.985. But the receiver is sensitive indeed, which also aggravates the problem of selectivity. I understand from the manual that 25 kHz repeater spacing is standard in Australia, where this kit originated. It might be advisable to make a tighter filter option available for the United States, especially for those who live near large cities.

As far as the transmitter goes, I received nice audio reports (some stations mentioned a tinny quality to the audio, indicating excessive high-frequency response). One model made by DSE involves increasing the size of the microphone input coupling capacitor to 10 uF from 1 uF to increase low-frequency response. The only adjustment on the microphone audio stage is for deviation and not microphone gain. I prefer both in FM transceivers, since the gain can very well be too high but the deviation can also be too low!

Other reports included excessive leakthrough of hash noise and alternator whine. The DSE Commander does employ a filter network consisting of a choke and capacitor, but it may need to be larger. I don't receive the same reports when using my Kenwood TR-7400. Using windshield wipers and the heater fan also created noise on the transmitted signal. These problems, however, are easily rectified (no pun intended).

This brings me to my major complaint: The audio output is very low for mobile operation, especially in a high-noise environment. The audio stage is rated at 500 mW output (so is the 8-Ohm speaker) and I usually had the audio gain all the way up, at which point I could copy signals most of the time, but that introduced a lot of distortion into the audio product. DSE needs to run at least 2 to 3 Watts output from the audio stage to overcome the absorption of carpeting and upholstery, as well as general ambient noise. I sort of solved the problem with an outboard 3-Watt power module stuffed into the cabinet.

Other than that complaint, this is a fun kit to build, and a useful rig around the house and car. Now, if they could just tighten up the receiver and boost the audio output...

AS REVIEWED THIS ISSUE!
VHF TRANSCEIVER

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Nearly 2000 amateurs can't be wrong! That's how many have now built our 2 meter kit in just a few months. Many letters & phone calls have praised the project. In fact a number of customers said they didn't really need another 2m transceiver, they simply built it for the sheer fun of making something again.

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Frequency: 144-148MHz in 10KHz steps (5KHz offset)
Mode of operation: FM
Suppy req: 12.8V DC 2.5A (15W output)
Receiver: Dual conversion Superheterodyne
Sensitivity: 0.5uV for 12dB quieting
Selectivity: Better than 60dB at plus/minus 25KHz.

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Lousy Inconsiderate Dummies

Recognize anyone?

It's my observation that any time two or more hams gather together, their conversation soon turns to the Lousy Inconsiderate Dummies (LIDs) who are ruining ham radio. The subject is not unknown to come up during QSOs, too. So, in my never-ending efforts to be helpful, I'd like your help in trying to identify the areas of expertise into which these lids fall.

Lids most certainly are a major problem for many of us, but before we can tackle the lid problem we have to identify and isolate it so we don't find ourselves diluting our problem-solving efforts by getting off on tangents.

Now, how should we go about classifying lids? Being of an engineering turn of mind, I tend to gravitate toward starting with Lid 01 and working up from there methodically. Perhaps I'm being optimistic—maybe I should start with Lid 001, since it's possible we might go over 99 types of lids! In some ways amateur radio seems to offer limitless possibilities—this may be one of them. I'll stick with Lid 01 for starters, and try not to be too testy if, with your expert lid-identifying help, we're able to describe over a hundred types of lids.

Lid 01. This is the rotten, lousy, dog-mothered SOB who jams nets by insisting on his witless rag-chewing on an Official Net Channel. For instance, the South East Asia Net (Seanet) is an incredible cornucopia of rare DX which can sometimes be faintly heard mornings on the high end of 20m. Two or three Chicago super-lids insist on using what must be at least ten kW to talk a half mile across town with each other every damned morning on the Seanet channel.

Lid 02. This is the ridiculous DX fanatic who suddenly wants you and your buddies, who have been talking on this channel every morning for several years now, to either shut up or move so he can annoy the hell out of a bunch of Asians who have a net on the same frequency and who probably don't want to be bothered by someone from the United States breaking in to get a DX contact anyway.

Lid 03. The unmitigated turkey who suddenly appears on your frequency calling some buddy of his on schedule, making a mess of your contact.

Lid 04. The stupid clod who is talking on your sked channel when your sked time comes up—despite your efforts to get him to move somewhere else in the band so you can hear your buddy—or even to shut up for a couple damned minutes so you and your sked can make contact and find a clearer channel.

Lid 05. The jerk who spends his time kerchunking the repeater, timing it out and making it useless for everone else.

Lid 06. The officious repeater user who insists on call letters being used because "it's the rules and regulations, fella"—despite the fact that everyone talking to each other recognizes who's talking at any time. This chap is quick to point out even the slightest infraction of the rules as he interprets them, often driving repeater users into a frenzy of impotent rage.

Lid 07. This is the senile ham who never, ever allows even one lousy microsecond between transmissions on the repeater. This chap is usually in contact with another 07, complete with an outrageous signal which can't be broken. These old boys can keep a repeater tied up, saying nothing whatever of interest, for hours on end.

Lid 08. This is the repeater mavin who sets his repeater so it times out in 30 seconds, thus assuring that his repeater will never be used for anything of any significant interest. This also makes certain that the repeater will continually frustrate virtually every user, driving the more loosely-coupled ham minds to thoughts of retribution.

Lid 09. This is a subset of 08, the repeater op who sets his timeout at one minute, thus making sure to aggravate almost anyone dumb enough to try and use his repeater for anything beyond kerchunking. His enjoyment is in having it there, taking up a valuable 2m channel, and being able to hear the soul-satisfying kerchunk when he pulls his HT from under his pillow in the middle of the night. Lid 09, when out of bed, is never seen without his HT on his belt. It is never tuned to any other channel than his repeater.

Lid 10. Say, we're getting into this, aren't we? This is the Novice who calls CQ endlessly using Morse code (reputedly used by the fathers of our hobby and memorialized by forcing Novices, who don't know any better, to use it). Morse code was abbreviated as MC in the early days. In an unfortunate accident, the type for a page in an old issue of *QST* was dropped on the HQ floor and the letters were put back upside down. The HQ staffers, being bureaucrats and thus not overly bright, refused to admit their mistake, saddling us forever after with the term CW for Morse code. I thought you might like to know where CW came from. Why the endless CQs? Simple: The Novice, being only able to send and unable to receive, having gotten his license via a good friend, wants to have the fun of transmitting, but doesn't want to be made to look stupid by not being able to copy any responses. The answer is to just send CQ and never listen at all.

Lid 11. This is the Novice who sits and listens to an endless CQ and then tries to call the

CQer, apparently being too dense to realize that the CQer has no intention whatever of responding to a call.

Lid 12. This is the chap who acknowledges, one by one, everything you've said in your transmission and then turns it back to you. Okay on the QTH there...okay on your rig...okay on your antenna...okay on your handle...back to you.

Lid 13. The idiot who makes a second transmission to Lid 12, other than to sign off.

Lid 14. The OSCAR user who dumps a kilowatt into the satellite, thereby overloading it and making it so no one else can use it.

Lid 15. The OSCAR user who complains because I've gone to the trouble to have a good solid signal into the satellite so I can be heard.

Lid 16. The DX fanatic who can't wait for a DX station to sign off with his present contact and insists on tail-ending with his call at every break in the contact.

Lid 17. The operator in a rare DX spot who goes back to tail-enders.

Lid 18. The DX nut who hears a pileup and jumps right in on top just to prove he can dominate the frequency with his rock crusher and twelve-element wide-spaced beam.

Lid 19. The cretin who is too dumb or too lazy to put a decent signal on the air who complains when you make your daily contact with your good old buddy on Lord Howe Island.

Lid 20. The traffic-handling dummy who can't even count the words in his messages right for the check.

Lid 21. The nit-picking net manager who fusses over an insignificant error in the check number—on a message obviously of no consequence whatever which probably will never get delivered anyway.

Lid 22. The inconsiderate lumpen who gets into a sideband rag-chew in the slow-scan part of the band.

Lid 23. The slow-scanner who plops his big signal down on your QSO and sends 15 steady minutes of chirping, wiping out your contact.

Lid 24. The high-speed CW op who's using a Morse-code computer and doesn't even know the code.

Lid 25. The low-IQ jealous CW op who is too dense to set up a computer to copy the code and who tries to make life miserable for the smarter ops who've figured out how to beat the Morse-code problem.

Lid 26. The disgusting old fart who insists on using four letter words on the air.

Lid 27. The old-timer who argues that since even the FCC hasn't been able to define what words can't be aired, why should some asshole object if he uses salty language now and then to express himself? If he doesn't like it he can damned well tune off.

Lid 28. The slow-scanner who sends endless *Playboy* and *Penthouse* centerfold pictures, filling the slow-scan part of the band, which is narrow enough as it is, with junk.

Lid 29. The slow-scanner who complains about someone sending beautiful pictures over the air—something a lot more interesting to watch than the hundredth dumb picture of a shack or a ham's ugly wife and kids.

Lid 30. The chap who calls you because he needs a QSL with your prefix, or from your state, your county, your zip code, or some other such impersonal reason. Why should you waste your time and postage on some jerk who has decided he is going to make WAS in 24 hours on 75m phone?

Lid 31. The ham who promises you a QSL for your Ten Band WAS and then doesn't send it.

Lid 32. The DX operator—usually in a very rare country—who refuses to respond to your QSL.

Lid 33. The DX op who sends his QSL to a rare country op or his QSL manager with the wrong date and/or the wrong time, making it a bitch to check the log. No IRC enclosed, of course. Doesn't this chap realize how much postage costs these days?

Lid 34. The first-time DXpedition operator who operates outside the American phone band and asks for calls between 14.100 and 14.200.

Lid 35. The DXer who jumps up and down between 14.100 and 14.200 calling the DXpedition on random frequencies, thus ruining contacts in progress in that band. Lid 35a is the slightly smarter DXer who listens with a second receiver or with one of those newfangled digital receivers to the DXpedition channel and also tunes the 14.100 to 14.200 band to hear where the DXpedition is listening—then jumps on top of the frequency and never mind who is already there.

Lid 36. This is the DXpedition or operator in a very rare country who is working an endless list provided by some cohort.

Lid 37. The DXer who gets nasty because he isn't on the list.

Lid 38. The mobile dingle who is driving to or from work and talking via the mountaintop repeater to a fellow dingle a half mile away. Much of the conversation has to do with expert criticism of observed poor driving practices in his vicinity, a subject of obvious deep interest to the dozens of chaps waiting to use the repeater.

Lid 39. The high-powered 2m op with a big beam who sits all day tying up the local repeater.

Lid 40. The mountain-topping frustrated DXer who ties up a half dozen repeaters on a channel trying to make a contact through just one of the repeaters.

Lid 41. The repeater user with absolutely nothing whatever to say who won't wait for a mountain-topping DXer to make a contact through a distant repeater, but instead uses a local repeater and makes the DX contact impossible.

Lid 42. The flying repeater user. This chap can tie up even more repeaters than the mountain-top DXer. His big complaint is the length of some of the squelch tails on some repeaters on the channel he's picked.

Lid 43. This is the dope who is eagerly trying to get through to the flying lid, tying up his local repeater and making so much hash on the channel the flying lid is unable to really hear anything.

Lid 44. The packet-radio op on the lower bands whose rig keeps endlessly repeating a message because his rig doesn't get perfect copy due to QSB, QRM, or QRN.

Lid 45. The CW op who gets frustrated by a packet-radio station and gets even by jamming it—resulting in the packet rig endlessly (and mindlessly) repeating the message.

Lid 46. The DXpedition operator who asks for donations to help defray the cost of the trip.

Lid 47. The DX operator who is too chintzy to help out with the incredible costs involved with putting on a DXpedition and who could easily afford to send along at least a tenner. If he's on the Honor Roll he's a cheapskate if he sends less than $100.

Lid 48. The DXpeditioner who operates from somewhere else than where he says he is, figuring what difference does it really make? After all, DXers can make contacts anywhere in the world and where you are is no less difficult for most of 'em to work than if you were where you said you are. I believe this approach was pioneered by W0MLY in his infamous operation in North Africa. Every contact counted for ARRL credit, so what the heck, right? I've gotten a whole bunch of QSLs for DX contacts where the operator wasn't really there—and they all count.

Lid 49. The DXer who pauses for one instant before making a DX contact just because the operator may not be where he says he is.

Lid 50. The unconscionable, fatherless chap who uses a rare DX call with reduced power just to have the fun of being on the power end of a pileup for a while. No, not one of the thousands practicing this deceit has ever been punished for this, but the freedom from fear of being caught should not encourage this outrage on innocent, trusting DXers.

Lid 51. The DXer who refuses to work a rare station because he suspects it may be phony. True DXers may complain, but they observe the fixed rule: Work 'em first and bitch later.

Lid 52. The ego-driven maniac who decimates a pileup to work a very rare station and then, after the contact, jams the channel to keep anyone else from working the rare one.

Lid 53. The Honor Roll DXer who gets a new one and then doesn't do everything in his power to keep his competitors from keeping up with him. Ruses include jamming the DX, asking the DX to move to 80m for a try, asking all sorts of questions which will keep the DX op busy answering until propagation has changed, and so on.

Lid 54. Contest operators who leave open numbers here and there in their contest logs to be filled in with mythical contacts (with missed countries, sections, or whatever) so a log cross-check won't give them away.

Lid 55. The contest op who doesn't use every known stratagem to win the contest. After all, his competitors are going to. If this means claiming 90 Watts out when more like 5,000 was used, who's to really know?

Lid 56. The ham club president who does all he can to keep young hams from messing up his club.

Lid 57. The youngster who comes to a ham club meeting made up entirely of old-timers—which is about what there is to choose from these days—and shuffles his feet when bored.

Lid 58. The ham who brags that he doesn't have any QSL cards when you ask him for one to confirm your contact with his state, section, zip code, county, or area code.

Lid 59. The ham who sends out a QSL for every contact he makes, creating guilt feelings with type-58 lids who don't have any QSL cards and are too damned rotten chintzy cheap to buy any.

Lid 60. A QSL fanatic who gets every QSL he can and indexes 'em in a big filing cabinet so he can pull yours out every time you contact him and make you feel guilty for not having his at hand.

Lid 61. The information fiend who makes a note of everything you mention during a contact and then, the next time you work him, even if it is years later, has total recall of the last contact.

Lid 62. The obviously brain-damaged operator who has no recollection whatever of his contact with you last week—or last month. The SOB doesn't even remember your name.

Lid 63. The op who has to be reminded every other transmission of your handle—or who never gets your call right twice in a row.

Lid 64. The nitpicker who is so organized that he writes down your name and call and thus never has to be reminded of them during a contact—proof positive of little imagination or creativity.

Lid 65. This is the cliché-er who will see you further down the log because he has to pull the big switch and modulate the mattress.

Lid 66. The ham who puts up with a cliché-user without screaming at him, suggesting he go back to CB where he belongs.

Lid 67. The ham who cheated to get his license and refuses to ever discuss anything technical so he won't give away his total ignorance of electronic technology and radio.

Lid 68. The frustrated pseudo-engineer who, at the slightest provocation (or with none at all), plunges into a deep technical treatise on something you have no interest in whatever. Any ham with some technical smarts will recognize immediately that this lid is full of partly-understood theory.

Lid 69. This is the chap in a round table where there are some YL ops who thinks it's cute to make constant double-entendre remarks, thus making the YLs and everyone else uncomfortable.

Lid 70. The YL with no sense of humor, who objects to being called OM and gets huffy at sexist remarks.

Lid 71. The self-important ham who quickly brings up his Jaguar, his twin-engine plane, his yacht, and other boring things.

Lid 72. The world-traveler who calls rare DX stations and sets up dinner meetings with them.

Lid 73. The ham magazine editor who, with obvious false modesty, doesn't mention Who He Is, thus making his contact feel like a real jerk when he finally figures it out—often after signing and hearing another station calling frantically to work said "famous person."

Lid 74. The ham who is so totally unread he doesn't know who the editors of the four ham magazines are so he'll recognize one when he hears him. This chap probably wouldn't even recognize Barry Goldwater if he worked him.

Lid 75. Any ham who tries to solve his own TVI problems without the help of fellow hams as intermediaries.

Lid 76. Any ham who refuses to help another ham with his TVI problems.

Lid 77. Any ham crazy enough to lend a fellow ham his rig while he's on vacation. The rig will never again be the same. There is only one case in all ham recorded history of a rig being returned in better condition than it was when borrowed and that ham is now living in Borneo (V85AA).

Lid 78. Any ham who borrows a rig from a ham going on vacation and expects the lender to ever again be on speaking terms after noticing the big scratch your junior op put on the front panel. (That's the scratch even the black magic marker couldn't hide.)

Lid 79. Actually this is a group effort—hams who turn up in a skiing village with their HTs and take over the local repeater for a few days, leaving the locals—the chaps who paid to put it up and keep it working—substantially irritated.

Lid 80. Local ops who fuss because a few visitors use their precious repeater for a couple of days.

Lid 81. The QRP fanatic who wants you to move over or shut up so he can make a tenth-Watt contact somewhere he shouldn't—often with some rare DX op who should better spend his time working stronger signals.

Lid 82. Mobile ops who add to the QRM by trying to work DX beyond their depth.

Lid 83. The 20m rag-chewer who steps all over QRP and mobile ops who are trying to do the impossible so they can get a lousy mention in *QST* for them to make into a plaque and hang on the shack wall.

Lid 84. The 3999er who insists his signal is not outside the band.

Lid 85. The 80m CW op who makes it a point to walk all over DX phone stations who operate in his CW band.

Lid 86. The 75m DXer who believes it is his right to work DX phone stations operating in the CW part of the band.

Lid 87. The Italian operator who spellsa everythinga for youa twice-ah.

Lid 88. Guess who.

Lid 89. Any YL ham who bridles at me writing "guess who" for Lid 88.

Lid 90. The 75m AMer who is obnoxious about being so far behind the current ham technology.

Lid 91. The 75m SSBer who makes it a personal vendetta to harass the 90s.

I'll leave a few for your suggestions. I suspect I haven't even really begun to tackle the lid problem we face as yet—so let's get the list over 100 and see where it goes. Once we get the list in shape, perhaps I should print it in poster form so you can hang it on your shack wall along with all your dumb certificates and other trivia to which you've dedicated your life—the stuff your kids will have to throw out, along with all those old worthless ham magazines, when you get your last mention in *QST*. ■

Lids, LOTMs, and ATLHR

Be assured that if you make an outstanding name for yourself in any one of the lid categories you could live in infamy well beyond your one-line Silent Key obit. Several hams have made my All-Time Lid Honor Roll—W2BIB, W2HH, W2OY, W0MLY, W1BUD, W2KR, and so on. What was Don Miller's call? Oh yes, W9NTP. I'll bet you have some nominations for the ATLHR.

If you have a favorite you think should be nominated for the Lid Of The Month (LOTM), send me his call and documentation to back up your nomination. I'll increase my libel insurance and we'll see what we can do to clean up this awful mess. We amateurs are supposed to be self-policing, aren't we?

No, I don't want to see vigilantes going out and lynching miscreant lids, no matter how soul-satisfying it would be. I remember when a bunch of Brooklyn hams got fed up with a local lid who would work only Spanish-speaking stations and who was very rude about this to his neighbors. A committee was formed to explain how the W2s felt. It was a large committee—not in numbers, but in weight—and it established the needed rapport. When he healed, the chap had a much better perspective on his new friends and was very nice on the air after that.

Y'all write, y'hear?...Wayne.

I'M BACK!...WAYNE W2NSD/1

Here are ten reasons why you're going to be all upset with yourself if you don't subscribe to *73* —Now!

1.) If we're going to get amateur radio growing again I'm going to need your help. I can do it, but not alone.

2.) You're going to enjoy the new life in *73*—articles on how and why you can get involved with packet radio, OSCAR, traffic handling, DXing, cross-band repeaters, RTTY, slow-scan, and so on.

3.) You won't want to miss *73*'s bargain DXpeditions—starting with Asia this October—going to Sarawak 9MB, Brunei V85 and Sabah 9M6.

4.) Will I be able to get 800,000 new hams licensed *per year* in China? I think I can—and you will want to read how I'm going to do it. I'll even tell you how to get such a program going in the U.S. We sure could use it!

5.) Are you interested in *73* reader evaluations of ham gear? Now you can vote on your gear and read what the other *73* readers think of theirs.

6.) Want to find out just how bad an operator you are? Read the LID list in *73* and weep. Better yet, shape up!

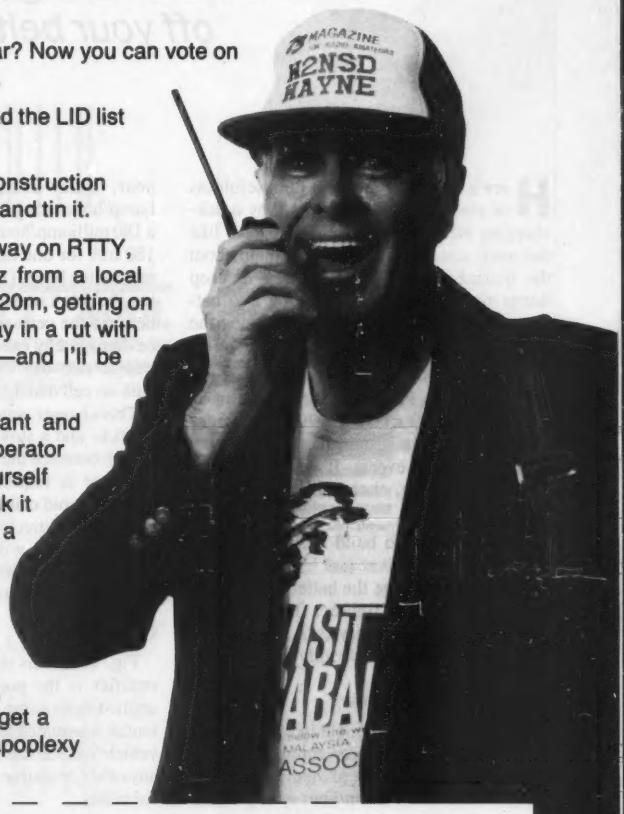
7.) How about building stuff? I'll be running all the simple construction projects I can get in *73*. Better get out your soldering pencil and tin it.

8.) I have a whale of a lot of fun building gadgets, typing away on RTTY, working high-speed CW, making DX contacts on 10 GHz from a local mountain (DX being a new state), working a new country on 20m, getting on the air from some very rare spot . . . stuff like that. Don't stay in a rut with your hamming, there are just too many fun things to do—and I'll be writing about 'em in *73*.

9.) I've forgotten what this was, but it was very important and persuasive. If I could remember it you'd call my 800 operator immediately with your subscription. You'll never forgive yourself if you miss out on this one . . . I remember that much! I think it had something to do with a whole lot of money—perhaps a free trip somewhere. Check *73* for the details.

10.) We're going to be reprinting some of the funniest ham humor from *73*'s sordid past. A medical checkup is recommended before reading.

11.) (bonus) Yes, I know *73* got pretty dull last year—well, well, I'm back and whatever *73* is, it won't be dull. Better get a refill on your Diazide so you won't be after me for giving you apoplexy when you read my editorials.



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Speed-Charge Your PB-21

This ac/dc charger gets your TH-21AT off your belt and on the air.

Here's a way to increase the usefulness of your Kenwood TH-21AT by quick-charging the battery pack. Most people like the small size of the HT but complain about the limited battery life. The way to keep things running smoothly is to get two batteries and use one while quick-charging the other.

I don't think that Kenwood offers a quick-charger for the PB-21, and the five-to-six-hour wait for the standard 110-volt charger isn't acceptable for sustained operations such as public service events. If you're not near a 110-volt source, the problem is further compounded.

The solution is to build a charger which accepts both 110-volt ac and 12-volt dc. This permits you to charge the battery from your vehicle's cigarette lighter. The nominal voltage of the HT battery is 7.2 V, and 12 volts will charge it quite readily.

Charge Rates for NiCds

As a bit of a side note, I'd like to describe the charge rates that can be applied to nickel cadmium batteries. Most of them can be fast-charged at their milliamp/hour rating for an hour, or slow-charged at one-tenth their milliamp/hour rating for 10 hours. For example, a 180 milliamp/hour battery can be charged at 180 mA for one hour (180 x 1=180), or 18 mA for ten hours (18 x 10=180). Fast-charging shouldn't continue for more than an hour because the cells will overheat and possibly be damaged by excessive gassing. The slow-charge rate can be maintained indefinitely with no cell damage.

This charger was designed to provide both a quick- and a slow-charge rate, but doesn't switch between the two automatically. Some vigilance is required from the operator in order to avoid cell damage. It's assumed that users will be involved in extended periods of operation and will be rotating batteries. Therefore, you should stay nearby to tend to the charger and extra pack.

Circuit Details

Fig. 1. reveals the plan. The output of the rectifier is the point where 12 volts dc is applied from some external source. This potential is assumed to be the 12 volts from your vehicle's electrical system, although it can be any other dc source. Be sure to fuse this input for safety.

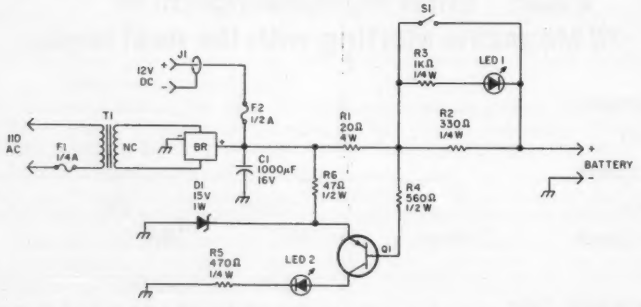

Fig. 1. Schematic of quick- and slow-rate charger for Kenwood PB-21 battery pack. This circuit can be used for just about any handie-talkie battery pack. Change the values of R1, R2, and F2 for the charging current needed.

The unit uses a 12-volt power transformer, bridge rectifier, and filter to provide the charging potential from 110 volts. This is relatively straightforward, but you should note that the transformer center tap isn't connected. The entire secondary voltage is applied to the rectifier. Regulation and ripple in the dc output aren't a concern because the potential is used to charge a battery and not power an amplifier. We have no intention of listening to a signal. No power switch is provided since no current will flow unless a battery is under charge. The battery is, in effect, the on/off switch. However, don't forget to fuse the primary of the transformer.

R1 limits the quick-charge rate to approximately 180 milliamps, which is the rating of the battery. R2 sets the slow-charge rate at 20 milliamps. LED 1 indicates low-charge-rate current flow and R3 limits voltage across it. Switch S1 shorts out R2 and the R3-LED 1 combination, allowing the higher current necessary for quick charging; this current develops enough voltage across R1 to foward bias Q1 through R4. Q1 functions in the circuit as a switch, and is driven into conduction by the applied bias. When Q1 is on, current flows from the emitter to the collector and turns on LED 2, indicating high-charge-rate current flow. Use a blinking LED to draw attention to the fact that the battery is being quick-charged. Resistor R5 limits voltage across LED 2 and R6 helps to set the bias point of Q1. Zener diode D1 protects the transistor in case a reverse-polarity voltage is accidentally applied to the unit.

Most of the parts used are garden-variety items with no critical or unusual components. Feel free to substitute. A discarded AM/FM circuit board can provide most of the parts. If you have a well-stocked junk box, you can probably build this charger for nothing. If not, some careful shopping at the next swapfest should yield everything, with the cost limited only by your ability to bargain. If

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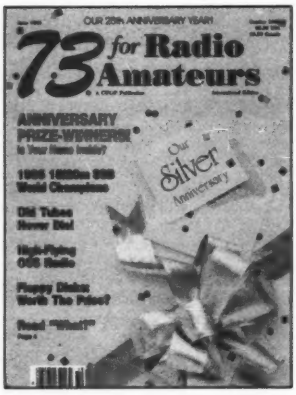

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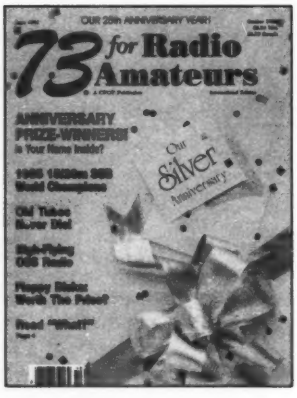

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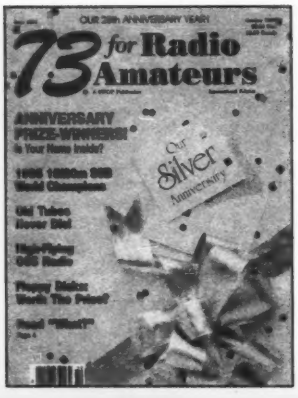

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all else fails, your friendly neighborhood Radio Shack should have all the necessary parts, except for the spring brass used for the battery contacts. Even here you may be able to use contacts from one of their battery holders. With Radio Shack as a parts supplier, the total outlay shouldn't be more than $35, according to their 1985 catalog. This price may seem high, but it assumes you have to actually purchase everything.

Beginning Construction

Begin construction by carefully cutting a slot for the Kenwood battery at one end of the project case. Mark the slot with a pencil by tracing around the battery; cut the opening slightly undersize with a keyhole saw. Then use a flat file to get it to the final size. Work slowly and don't let the opening get too big. It should hold the battery firmly in an upright position, and not allow it to rattle around or shift in the opening. This prevents loss of contact when the charger is used in a vehicle that is in motion. Remember, if there is no contact with the battery, no charging takes place.

The project case suggested has internal slots for circuit boards, and this method of mounting is used for the power supply. The transformer is the bulkiest item, but with a little care all of the items can be placed on one vertical board.

A second board is used for the battery contacts. This one is mounted horizontally on four long screws that function as posts. Put extra nuts on both the underside and the top of the board to provide a firm platform for holding the HT battery (see Fig. 2).

Now comes the only real home-brew portion of this project, and it requires some resourcefulness on the part of the builder: The charging contacts of the battery should be made from some sort of spring brass or shim stock. I fashioned mine out of a piece salvaged from a discarded doorbell switch. The brass strips were cut to match the contacts of the HT battery pack. I drilled one end of the strips to accept a mounting screw and attached them to the circuit board. Next, the strips were carefully bent into a horseshoe shape to provide the spring necessary for good contact. In use, the weight of the pack against the springs makes the required connection for the charging current. I recommend that brass hardware also be used for mounting to keep electrical resistance low.

Now construct the power-supply board. This one should slip into the slots provided inside the project case. An etched board will add that commercial touch to the project, but point-to-point wiring will work as well. Once the cover is on, no one but you will know the difference.

Because of the small number of parts and the room for liberal substitution, I haven't provided a circuit-board layout. If your junk box yields something that will work but is different in size or lead configuration than the part specified, such a layout would have little value; hence, the builder is left to determine the best component placement.

I found the following steps convenient: The

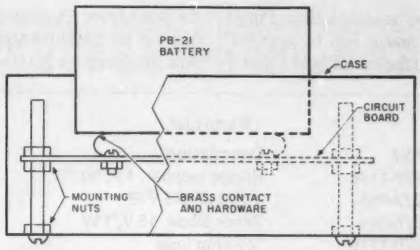

Fig. 2. End view of case and cut-away portion showing brass charging contacts and method of supporting the battery while in the charger. Drawing is not to scale.

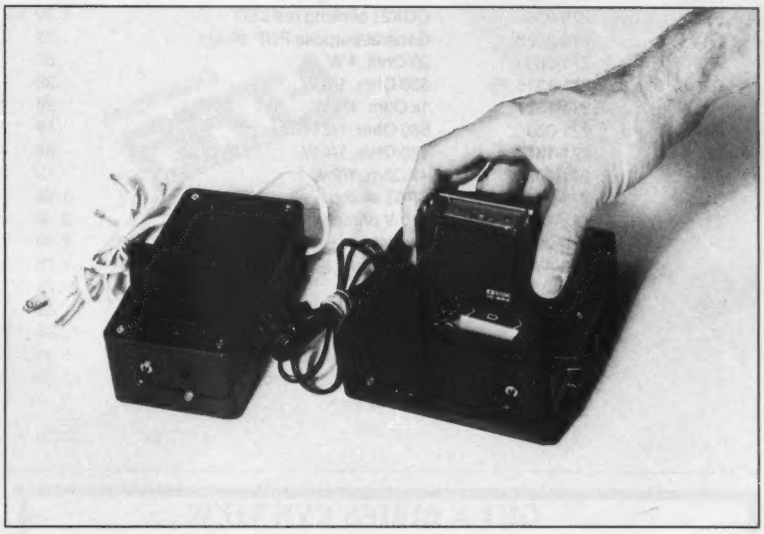

Photo A. The charger described in this article is shown on the left. The photo gives a good view of how the battery pack is held while being charged. The unit on the right uses the same circuit, but the values of R1, R2, and F2, along with the power transformer, have been changed for the higher current required by the ICOM BP-4 pack. Construction of this unit preceded the one described in the text.

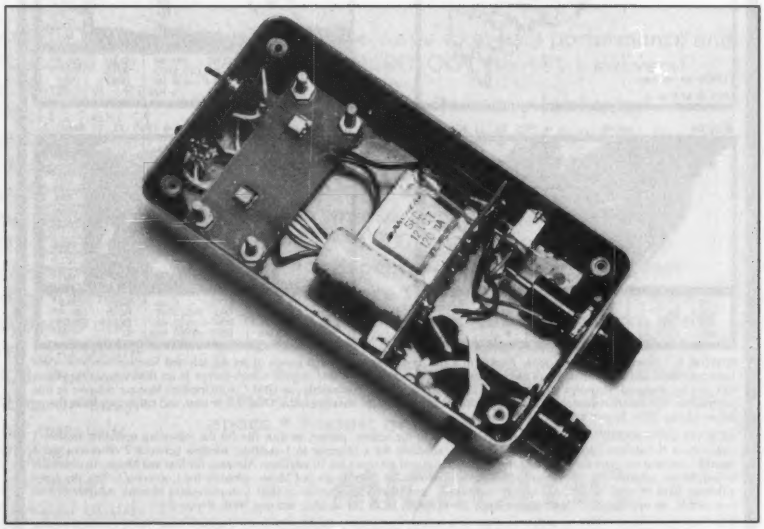

Photo B. Here, the unit is shown with the cover removed. At the left is the circuit board and charging contacts that support the battery while it is being charged. In the center is the power-supply board. At the right are the power connections. Clockwise from top they are: 12-volt dc input, 12-volt fuse, 110-volt primary fuse, and line cord.

transformer should be mounted first. Put it low on the board so that it will be near the bottom of the case and the circuit board won't be top-heavy. Putting the primary connections at the bottom keeps the exposed 110 ac to a minimum—a good safety move.

Parts List

Part	RS#	Description	Price
BR	276-1146	Bridge rectifier, 4 A, 50 Piv	1.39
C1	272-958	1,000 uF, 16 Vx2	.99
D1	276-564	Zener diode, 15 V, 1 W	.89
F1	270-1270	1/4-Amp fuse	.69
F2	270-1271	1/2-Amp fuse	.69
J1	274-1549	Power connector	.99
LED1	276-022	T-1 3/4 LED (green)	.79
LED2	276-036	CQX21 blinking red LED	1.29
Q1	276-2023	General-purpose PNP silicon	.79
R1	271-080	20 Ohm, 4 W	.69
R2	271-1315	330 Ohm, 1/4 W	.39
R3	271-1321	1k Ohm, 1/4 W	.39
R4	271-020	560 Ohm, 1/2 W	.19
R5	271-1317	470 Ohm, 1/4 W	.39
R6	271-009	47 Ohm, 1/2 W	.19
S1	275-624	SPST switch	1.49
T1	273-1360	110-V primary, 12 V c-t	2.49
	270-223	Project case	2.69
	270-364	Fuse holder (2 required)	1.78
	278-1255	Line cord	.79
	278-1636	Strain relief	.69
	64-2346	Self-stick cushion	.89
	276-1576	Circuit-board kit	8.95
	64-2890	Hardware assortment	1.59
	278-1296	Hookup wire	2.19
		Total	34.30

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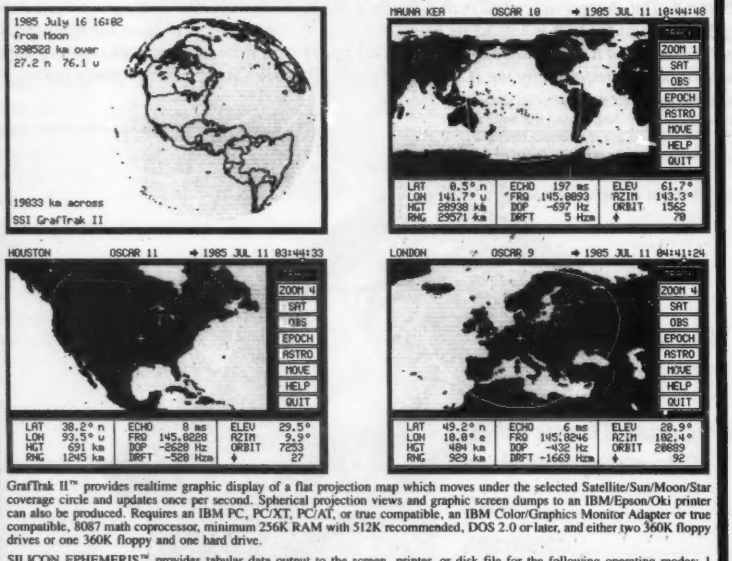

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Next, mount the filter capacitor, since it is also somewhat bulky. The other items occupy little space and can be placed at will, but give some regard to the heat generated by the power transformer. When the circuit boards are complete, set them aside. Mark and drill the case for the fuse holders, power cord, switch, LEDs, and 12-volt-dc connector. Mount these items and proceed with the final wiring. I chose to simply glue the LEDs into the proper size hole. Allow extra length in the wiring to facilitate servicing.

When complete, check the charging current by using clip leads and an ammeter. Typical values should be 18-24 mA for the low rate and 180-200 mA for the quick rate. If all is satisfactory, put the unit into service.

Using the Charger

At this point, I'd like to include several notes on the use of this charger. As I mentioned, the battery pack should *not* be left on fast-charge for more than one hour. Doing so may damage it. Since the charger doesn't automatically reduce the charge current, some care is required. Don't forget that the battery is on fast-charge.

If the battery isn't needed at the end of one hour of fast charging, switch to the low rate. It can be on low-charge for an extended period of time without damage.

I've been using this charger for more than three months with no problems. It has been used during public service events to fast-charge from a 12-volt automobile battery. I did manage to fry one battery, but that was due to my own forgetfulness.

Kenwood says nothing about fast-charging the PB-21 battery; therefore, I don't recommend using this charger while the battery is still under warranty. The battery must be removed from the TH-21AT for charging.

This basic circuit can be adapted to just about any HT battery pack. As shown in Photo A, the forerunner to this project was a quick-rate charger for the ICOM BP-4 containing six AA cells. The only problem that developed with this version was oxidation of the brass contacts.

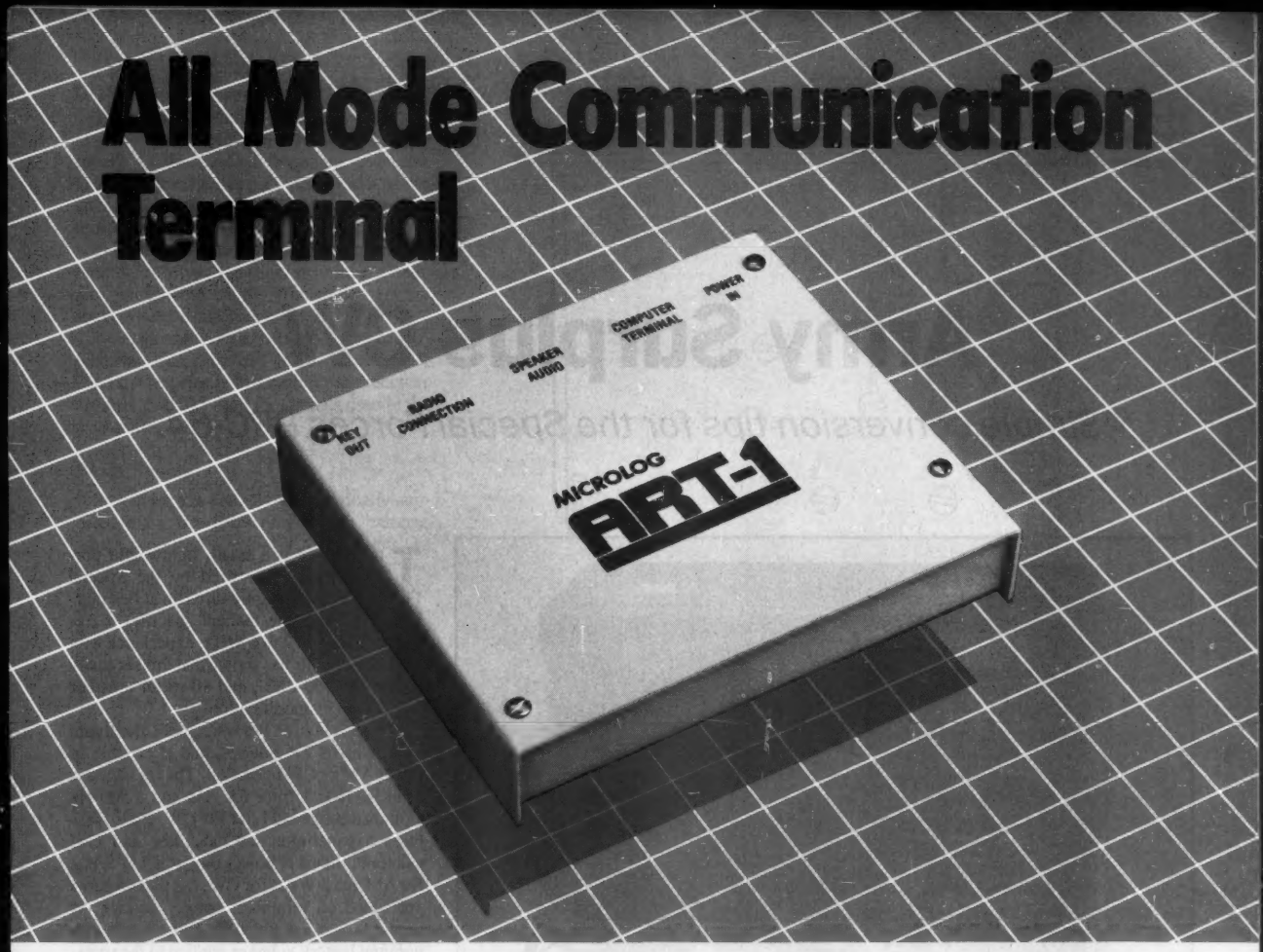
The objective of the charger cicuitry is to limit charging current flow at the quick-charge rate with R1 and to the low rate with R2. Some manipulation of Ohm's Law will give you values for these components.

Make sure the secondary of your power transformer can supply adequate current or it may be damaged. Some overload can be tolerated, since quick-charge current is drawn for a limited time. As I have described, S1 shorts out R2 to provide manual selection of the charge rate.

LEDs 1 and 2 are used to indicate that there is good battery contact and that there is a charging current flow. They won't light unless there is current flow. I prefer to use green or yellow for the low rate, and a flashing red for the high rate, which is better at getting the operator's attention.

Thanks go to Don Kollmorgen K8VIG for his help and for the photos used with this article. Have fun building! ■

All Mode Communication Terminal



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Army Surplus CW

Simple conversion tips for the Special Forces PRC-64.

The Delco 5300B, the CIA version of the PRC-64 transceiver.

The PRC-64 is a small, lightweight portable transceiver used by the Special Forces which frequently turns up at flea markets. Although the manual specifies a frequency range of 2 to 6 MHz, experience with a variety of units has shown that this set easily covers the 160-, 80-, and 40-meter amateur bands with no modification.

The set is housed in a waterproof aluminum case, weighs 7½ pounds, and is capable of either AM or CW operation. The rig includes a 6-kHz ladder filter for AM and a 500-Hz Collins mechanical filter for CW. It also features a panel-mounted hand key and CW sidetone. Stated rf power output is 1½ Watts for AM and 5 Watts for CW, but these figures are based on minimum battery voltage; rf output is nearly doubled for either mode with nominal battery voltages applied to the transmitter stages.

Variants

It's good to keep in mind that you may encounter variants of the PRC-64. The Delco 5300 is the CIA version of the PRC-64, but it is electrically and physically the same. The PRC-64A includes an oscillator control circuit that prevents chirping and key clicks when transmitting CW at 300 words per minute with the GRA-7 Burst Encoder. The third variant that we've seen appears to have been produced in a very limited quantity. It can be easily identified by its lack of a bandwidth switch and its microswitch hand key. There are also at least two frequency-synthesized variations of this rig; the Delco 1600 is frequency-synthesized from 2 to 10 MHz, has a tunable receiver, and features AM modulation. The Delco 3200 is the same except that it has single-sideband modulation.

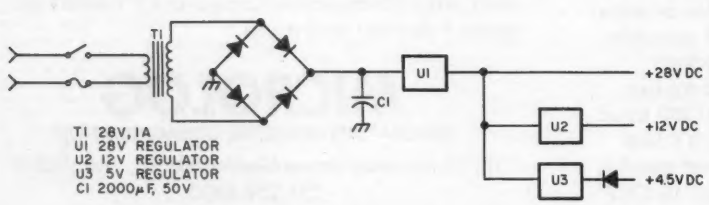

Fig. 1. Power supply.

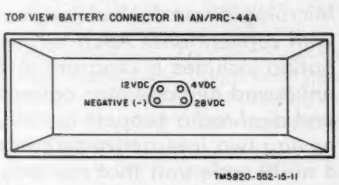

Fig. 2. Pin connections for input voltages.

Crystals

The receiver requires crystals in CR-78/U holders. The receiver crystal frequency should be the desired frequency plus 455 kHz. The transmitter requires crystals at the operating frequency in CR-89/U holders. For those of you with the Delco 5300, some, if not all, of these sets use CR-78/U holders for both the receiver and the transmitter. Check the pin spacing of the transmitter crystal sockets before ordering crystals.

You can order crystals from Sentry Manufacturing Co., Crystal Park, Chickasha OK 73018. The price is $10 each for the receiver crystals, and $13 each for crystals used in the transmitter.

Power Supply

Power for the PRC-64 was originally supplied by a BA-1509 magnesium battery, which produced 4 volts for the receiver, 12 volts for the oscillator, and 24 volts for the transmitter final stage. This battery probably isn't available now, so you'll have to construct either an ac power supply or a battery pack. The schematic for the power supply is shown in Fig. 1. Pin connections for the input voltages are shown in Fig. 2. The female plug for this connection is a Cinch-Jones number 13279. The 70-mA current requirement of the transmitter rules out the use of ordinary dry cells, so if you are contemplating portable operation, the battery pack should be built using heavy-duty NiCds.

Once you have a suitable power supply built and your crystals have arrived, you can proceed with the tune-up phase. We suggest that you double-check your connections before you accidentally hit the switch. Applying 12 or 28 volts to the 4-volt pin means instant death for the receiver.

Tune Up

To tune up the rig you'll need a 10-Watt, 50-Ohm resistor, a couple of tweaking sticks, and a 600-Ohm headset, if you aren't fortunate enough to get the original earphones. Install the receiver and transmitter crystals in their appropriate sockets. Each channel covers only a specific frequency range, as follows: channel 1, approximately 1.9–2.8 MHz; channel 2, 2.8–3.65 MHz; channel 3, 3.6–4.7 MHz; channel 4, 4.6–7.2 MHz.

To tune up the receiver, set the receive-send switch to receive, the bfo to off, the B/W switch to 6 kHz, the gain control to maximum, and the receiver channel switch to the proper channel. Connect the 50-Ohm, 10-Watt noninductive resistor between the antenna and ground terminals. Referring to Fig. 3, adjust the rf collector coil for this channel for maximum noise in the headset.

To tune up the the transmitter, set the receive-send switch to send, the loading control to 1, the AM-CW switch to CW, the IND-SENS switch to 3, and the transmitter channel switch to the proper channel.

Refer to Fig. 4 and adjust the driver coil and final amplifier coil for this channel for maximum brightness of the antenna indicator lamp while depressing the panel telegraph key. Turn the IND-SENS switch to the lowest number that will give an indication and again adjust the two coils for maximum brightness of the lamp.

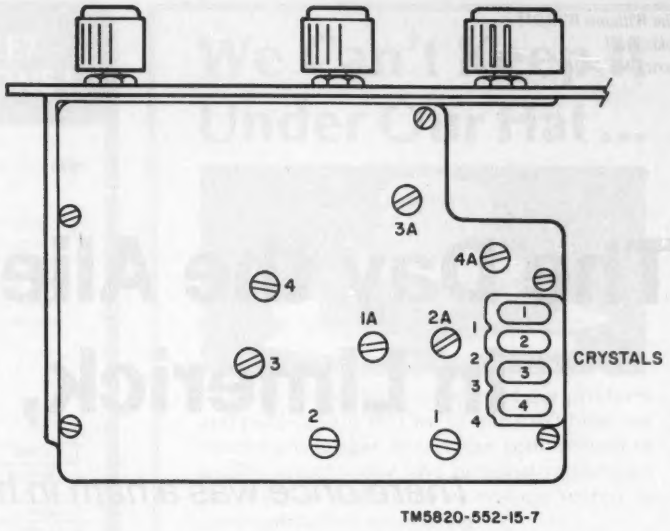

Fig. 3. Use this map to match the channel number to the appropriate rf collector coil.

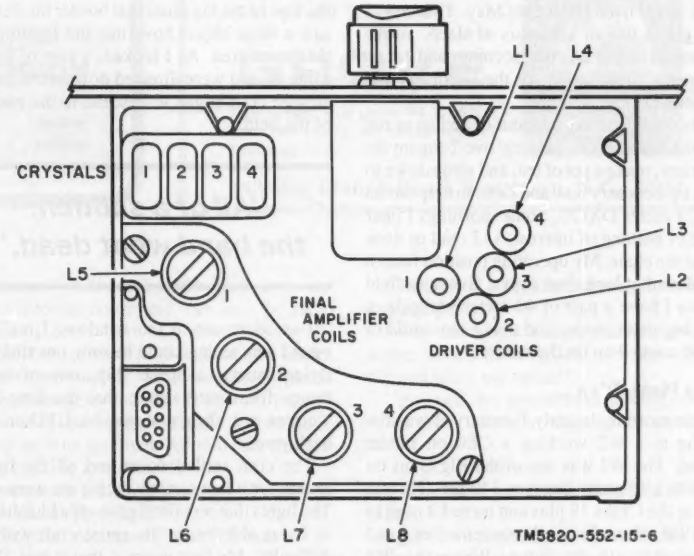

Fig. 4. Final amplifier and driver stage tuning adjustments.

Manual and Accessories

The technical manual for this rig is TM 11-5820-552-15. It is available from most dealers of surplus manuals. We also have a few copies. For AM operation, a standard dynamic microphone works well. The earphones are 600 Ohms. (The earphones from the PRR-9 rig work well.) The rig was originally furnished with a 50-Ohm dipole antenna wound on three reels, but any standard antenna from the handbook works well with this rig. For replacement transistors in the receiver, 2N207 will replace all but the audio transistors. The equivalent number of audio transistors is 2N706A.

External Key

An external key, or electronic keyer, may be used by plugging the key into the socket provided for the high-speed burst keyer. Wire the keyer to pins A and D of an Amphenol 125–195 plug. Ground is pin A.

In summary, the PRC-64 is an excellent portable or emergency QRP rig that is readily available at a reasonable price. It requires no conversion other than a tune-up and the acquisition of the crystals and accessories.

We'll answer any questions from amateurs who have either experience with this rig or questions about it. We are also interested in talking to anyone who has experience with synthesized versions. ■

C. Jim Williams W1ROM
Sokokis Trail
Limerick ME 04048

The Day the Aliens Landed in Limerick, Maine

There once was a ham in his shack . . .

As a general rule, I go to bed early (7 p.m. or so) from October to May. That way, I can get in five or six hours of sleep, awake refreshed at 1 or 2 in the morning, and get on 75-meter phone ready for the European and African DX.

My routine is to sneak out of bed so as not to disturb the XYL, feed my two Tanganyika Terriers, make a pot of tea, and settle down to pick up a country now and then, to help out on the 75-meter DXCC. Some mornings I hear little or nothing of interest, so I read or doze off in the chair. My operating position faces a window that looks out over a five-acre field where I have a pair of 40-meter verticals, a few big delta loops, and about ten cords of wood stacked up for the winter.

It's a Plane, It's a ...

One morning in early February, I was listening to a W2 working a CEØ on Easter Island. The W2 was one of the Big Guns on 75 with a 75-meter beam up 140 feet. He was giving the CEØ a 59 plus and turned it over to the CEØ, whom I copied between a 3 or 4 and signal strength the same. When the W2 signed, I called the CEØ but he came back to a W3. After four more tries, I finally snagged him and was grateful for the 34 he gave me.

There's not too much activity at 2 in the morning from W1-land, but a few W1s and W2s called the CEØ, and I half-listened while drinking a cup of tea.

All of a sudden, the band went dead—by dead, I mean nothing, absolutely no sound from the receiver. I figured the headphones had gone sour. I unplugged the phones and still heard nothing. I thought the 830S had "bought the farm" for sure. I could see myself packing it into the box and shipping it off to W6 land for repairs.

Since the window in my shack is in the back, as I looked at the receiver I noticed light, and it was getting brighter. Now, at 2 a.m. it just isn't natural to see light out in my back yard. Two steps took me to the window, where I damn near had an embolism! Looking straight out into the field and directly over the tops of the big pines that border the field, I saw a large object hovering and lighting up the entire area. As I looked, a row of lights came on and were directed downward, and a strange craft began to descend to the middle of the field.

"All of a sudden, the band went dead."

I stood frozen at the window. I realized what I was seeing could be only one thing: a flying saucer, a space ship, one of those things from outer space that the long-hair weirdos are always seeing—a UFO in my back yard!

The craft settled down and all the lights except for a few directly facing me went out. The lights that remained gave off a bluish tint, so I was able to see the entire craft without difficulty. My best guess is that it was 75 to 100 feet wide and 30 to 40 feet high above the outrigger-type legs that were supporting the craft on the ground. All I could do was stare out the window wondering what the devil to do next.

I don't remember how long I stood there, but the receiver came back to life, and I made a quick stab at turning down the audio gain. When I looked out the window again, a section of the craft was being lowered to the ground and a set of stairs telescoped from the section to the ground. My heart was pounding so fast and I was so scared that I could do nothing but watch as two figures descended the steps and stood looking directly at me. The craft and two figures were only about 200 feet from where I stood, so I could see them clearly. They appeared to be of average human height, both rather slim and dressed in black gowns that fit close at the neck. Both figures had white hair that came down their faces as far as the eyebrows—what we call "bangs" on this planet.

Suddenly, both figures bowed from the waist in my direction. When they straightened up, one of them motioned for me to come toward him.

Hams From Another Planet

I'm sure some of you would have said at this point, "Don't go out there—not on your life. Stay put; call the cops. Call the Air Force. Call up all the prayers you know, pal, because you're going to need them, fast."

I did none of those things. Instead, I left the window, put on my hat and coat, went out the back door and walked up into the field toward the two figures, who were still at the foot of their craft. As I approached, I noticed both had normal faces and skin tone; in fact, one of them reminded me of an old buddy of mine. When I got within five feet of them, one of them spoke!

"Greetings. We mean you no harm. We come in peace. My name is Douga and he is Billo." The creature pointed to the other figure.

My mouth was so dry and I was shaking so much I could barely stammer, "How do you do?"

Douga, the one who had spoken, had a little star on the collar of his black robe. I took him to be the *numero uno* creature.

"We are from the planet Prado in the galaxy of Volar, and we have been monitoring your radio signals for some time now," said Douga. "We would like to talk with you and learn many of your customs, and perhaps you will tell us what these strange objects are and what they have to do with your radio signal." While Douga was talking, he pointed towards the Rohn tower with the 6-element Telerex and at the verticals and delta loops and slopers that populated my back yard.

"You mean the antennas?" I asked, sort of pointing to them all with a sweep of my arm.

"Antennas? Is that what they are called?"

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AS - 80	80, 40, 20 METERS	78 Ft.	99.00
AXS - 80	80, 40, 15 METERS	64 Ft.	99.00
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GROVE

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Billo reached down and removed a glowing object from his belt, pointed it at each of the antennas and them put it back on his belt.

"What was that for?" I asked.

"Don't be alarmed," he said, "I was only checking the radiation output. We are extremely interested in the design and size of these instruments."

Douga asked, "Would it be possible for us to look at your radio equipment? We are very interested in what you use to radiate such a strong signal. We have been monitoring your planet's signals for some time now and yours stands out as one of the strongest and most consistent."

Now I always feel pretty proud when some DX station gives me a 59, but when some creature from outer space tells me I have a big signal and wants to look over my antenna farm and rig, *that's* a compliment.

"Sure," I said, "come on into the house and I'll show you my rig." We walked towards the house, and when we got near the 100-foot Rohn with the tribander, Billo looked up at the beam, put his hand on his belt, and flew straight up in the air! He hovered around the level of the tribander and examined the elements. When I could talk, I said, "How the devil does he do that?"

"Anti-gravitational thrust," Douga replied calmly. "Do people on this planet use anti-gravitation?"

"I've never even heard of it," I told him, "but it would sure come in handy working on antennas." We reached the back door and went into the house and then into the radio shack. I don't have the best shack in the world, but I do have a TS-830, an L4B linear, an antenna coupler, a keyer, and a few pieces of 2-meter gear—not bad for an old-timer—plus a nice operating chair and a couch to grab a nap on now and then. All told, my shack is nothing to be ashamed of.

I remembered my manners. "Would you guys like a cup of tea?"

"I don't understand," said Douga.

"100 Watts into the Mark V at 14.2 MHz would radiate 1,420,000,000 Watts."

"It's a hot drink we enjoy on this planet. Would you like to try some?"

"Yes, thank you. May we examine your radiator?"

"Radiator! What's that?" I asked.

Douga pointed to the equipment.

"Sure," I said, "help yourself. I'll put water on for tea."

After I put the water on, I returned to the shack and found them both talking in a strange tongue. Billo was pointing the glowing belt-buckle at all my gear.

"Jim," said Douga in English, "how old is this equipment?"

I was taken back a little that he knew my name, since I hadn't given it to him. "How did you know my name?"

"As I said, we have been observing you for some time. Are you offended by my using it?"

"No, of course not."

"How much power do you radiate?" Billo asked.

I grew two feet taller as I gave the answer. "I can squeeze out 2 kilowatts on SSB and 1 kilowatt on CW."

"You use CW!" They looked at one another in amazement, then smiled. "Would you have the radiator path for this?" asked Douga.

"What's that? I don't understand 'radiator path.'"

"It's the electronic sequence of the equipment, or how it actually works."

I thought for a moment. "Do you mean the schematic?"

"Schematic? We do not know that term but perhaps if I could show you..." He pointed to the pencil and paper on the desk.

"Help yourself," I said.

Douga only had to draw a few lines before I knew what he wanted. He was drawing the output circuit showing a coil, capacitors, and some strange symbols I had never seen before. I opened the filing cabinet and took out the Kenwood manual for the 830, opened up

to the double-page schematic, and laid it on the table.

Billo immediately pointed his glowing buckle at it, and the two of them started chattering in that strange language again.

The tea kettle burst into song, so I headed for the kitchen while they were looking at the 830 schematic. When I returned with a tray and three cups of tea, we all sat down and I watched their faces as they tasted the tea. Both of them seemed to be delighted with the taste.

"What is this called?" Douga asked.

"It's tea. It comes from Asia. Do you know where that is?"

Both shook their heads. "Point to Asia," Billo said, indicating the Great Circle map on the wall.

I put my finger on India, and they both nodded their heads. "We know that part of your planet," Billo replied.

Douga pointed to the 830 and the L4B. "Is this the latest in your technology? What power do you run?"

"The exciter, the 830, puts out about 100 Watts, and the amplifier somewhere near 2 kW SSB." I got up the courage to ask the question that was *really* on my mind. "By the way, what are you two up to? It's not every day one gets visitors from another galaxy. Are you guys planning on taking over?"

"Oh, no" was the reply. "We are doing nothing but observing your culture and technological status and comparing them to ours."

"What have you found in regards to radio?" I asked.

"We hope you are not offended," Douga said politely, pointing to my rig. "This technology is 75 to 100 years behind ours."

"I don't understand," I said, "this is a late-model solid-state transceiver. It's the state of the art. What do you guys have that's so superior?"

Douga finished his tea, set the cup and saucer down, and looked and Billo, who nodded his head and smiled.

"Jim, your type of radio technology is based on the scientific principle that radio waves are generated in the transmitter section and then coupled into an antenna where they are radiated into space. If you remember the old theory of dropping a stone into a body of water and seeing the rings or circles spreading out from the point of entry, these rings spread outward to infinity and are supported or strengthened by additional rings caused by more stones being dropped into the water or some type of a wave generator."

"I know that theory, and it works. It's the basis for how radio signals go out from the antenna and are picked up all over the world," I replied.

"True, the old ones on our planet have recorded this type of radio technology, but that was many years ago. Have you no knowledge of ART?"

"ART? What's that?"

"It's Additive Radiation Technology, and it's the basis for our communication technology."

"Tell me more."

"Well, to put it into the simplest terms, when we radiate a radio signal with our equipment, the radiated waves, as they leave the antenna, are increased in intensity by the Herma action of the Wallo gate. In other words, as the signal is radiated into space, the speed of transmitted waves is varied so that one wave catches up with the preceding wave and makes it stronger. When all the waves reach the first wave, you have a tremendous signal going forward into space.

"This technology is 75 to 100 years behind ours."

"You must understand that the first wave generated travels at the speed of light, or 186,000 miles per second; in order for the succeeding generated waves to catch up to it, we vary the speed of the following waves up to one million miles per second so that each wave catches up with the one ahead of it and increases the master wave strength. Do you understand what I am saying?"

I really didn't know what the heck Douga was talking about but I wanted him to go on, so I said, "Oh, yes, I follow you."

He continued, "You can see that if a small amount of radio signal is generated, say on 30 MHz, you have 30 million cycles generated per second, and if every cycle adds to the strength of the first one, even by a small amount, the increase in signal strength is phenomenal. For example, let's take a generated signal of 1/1000 of a Watt at 30 MHz, okay?"

"I follow you, go on."

"If each following cycle, and there are 30 million of them, adds its 1/1000 of a Watt to the first cycles, you'll have 1/1000 x 30,000,000. In other words, a combined strength of 30,000 Watts has been added to the first cycle and that's what hits the receiving antenna. Of course, this is not possible without the action of the Wallo gate, which increases the wave speed in such a ratio that all 30,000,000 cycles catch up to the first generated wave."

"How long have you guys had this kind of equipment?" I asked.

"For at least 75 years," Billo said.

"Jim, there is something else you should know about the signal," said Douga. "Once you select a frequency, say 21.250 MHz, and start to transmit, the Hallis discriminator imposes an absorber that is attached to your frequency and destroys all other signals that come anywhere near 21.250 MHz. This means that no other signal can come within 5 kHz or it will be totally absorbed and dissipated by the action of the Hallis."

59 Plus

"Let me get this straight," I said. "Are you guys saying you have a radio that takes a 1/1000 of a Watt radio signal and boosts it up to say 30,000 Watts out in space, and then by some means prevents any other signal from coming closer than 5 kHz to it?"

Yes, that's the basic performance of our radio technology," replied Douga.

"Have you got one of those radios on that craft out there?"

"Yes, we have. Would you like to see it?" asked Billo.

"God, would I!"

Douga said something to Billo in that funny language of theirs, and Billo left the room. When he came into the shack, he had a small box about the size of a Drake TR4 in his arms. He placed the box on my operating table. I could see it had three or four dials on the front with four or five knobs and a tube-like device sticking out of the back.

"Let me show you how this works," said Douga. He reached down and snapped on a switch and a window lit up showing a digital display and readout of 9,500 GHz. Douga touched another button and the display stopped at 14.175 MHz.

"May I attach your antenna to this?" he asked.

I disconnected a PL-259 from the B/W switch and passed him the coax, the other end of which was connected to the 6-element Telerex up 110 feet in the air.

"I should mention," said Douga, "that the receiver signal goes through the same process as the transmitted signal; in other words, it is amplified—in this case, 14,175,000 times—via the reverse Wallo gate action."

"Of course," I nodded.

Douga stuck the PL-259 coax connector somewhere into the back of the box and turned on another switch. Audio came forth from the box. It took a few minutes to figure out who was talking to whom on 14.175 MHz, but whoever it was had a 5-9 plus signal and was in the clear. The guy signed. It was KH5ZZ on Palmyra signing with a W6.

"Who is he?" asked Billo.

I explained that Palmyra was an island in the Pacific and that it was a long ways off and good DX.

I pointed towards the box, "Is there any way I can use that thing to talk to that KH5?"

"Oh, yes, it's very easy. All we need to do is plug in the mike."

I passed him the D104, and he plugged it in and passed me the mike. "Go ahead, call him," he said.

"KH5ZZ, KH5ZZ, this is W1ROM, do you copy?"

"W1ROM, this is KH5ZZ. Good morning, old man, you have the strongest signal I have ever heard from the states. In fact, you have pegged my S-meter. Are you really a W1? W1ROM from KH5ZZ."

I went back and to the KH5 and assured him I was a W1 and gave him a line of talk like conditions were super between us and there was a window opened between us. I couldn't tell the guy what was really going on; he would have though I was off resonance.

"My God," I said to the two guys with me, "this is great. I would love to have this thing for a while."

Douga looked at Billo for a moment, then he said, "It's yours, Jim. You may have it for one year, and then we will return and visit you again."

"You're kidding!"

"No. It's yours. Let us show you a few more operating points." They went on to explain that the output of the 830 could be connected into the Starbeam Mark V, as they called it, and explained that whatever was put in, depending on the power and frequency, the results would be the power times the cycles per second and that reasonable caution should be exercised. They went on to say that, for example, if I put 100 Watts into the Mark V at 14.200 MHz, I would radiate 100 x 14,200,000 or 1,420,000,000 Watts on that frequency only. They cautioned that this amount of power could burn out most radio receivers.

I asked where the power cord was, and they said the radio had an internal atomic power source that would last for at least 1,000,000 operating hours.

"We ask two things in return, Jim," said Douga.

"Name them," I said.

"We want to hold a monthly meeting with you on 9,555 GHz. You can do this by dialing up the frequency like this, and you can use any antenna because the circuit in the Mark V will automatically adjust for any antenna."

They suggested the last Sunday in each month at 2315Z. If anybody out there has a receiver that goes to 9,555 GHz, you might hear us some Sunday night.

"What's the other thing?" I asked.

Douga looked a Billo and then back to me. "We would like to take some of your tea back to Prado."

"You got it." I went into the kitchen, dumped what tea was left in the jar, and took a full pound out of the closet. I put them together in one bag and went back to the shack, where I passed the bag to Douga.

"Thank you, Jim. Our visit has been a pleasure."

"The pleasure is all mine, old buddy," I replied.

"Old buddy?" said Billo. "Are you a CBer?"

"CBer? Oh, no! I want no part of that outfit."

"We listen to them now and then and have decided there is not much in their technology that would interest us. It's time we were leaving, Jim," said Douga. "We appreciate your hospitality, your tea, and your explanation of your fine rig here."

"We'll see you again," added Billo.

We all shook hands after I explained that this was a custom on Earth between friends. I walked out to the craft with them, and as they entered, Douga looked back and said, "Remember our schedule now, every last Sunday of the month."

"I won't forget. See you later, fellas."

Douga looked down at me for a moment. "73s," he said and smiled. "I know there is no 's' on it, Jim, but take care." He entered the craft, the stairs went up, and the door closed. A row of lights came on and a humming sound became more intense. I moved back away from the craft as it started to rise gradually, picking up speed. In a few moments it was out of sight.

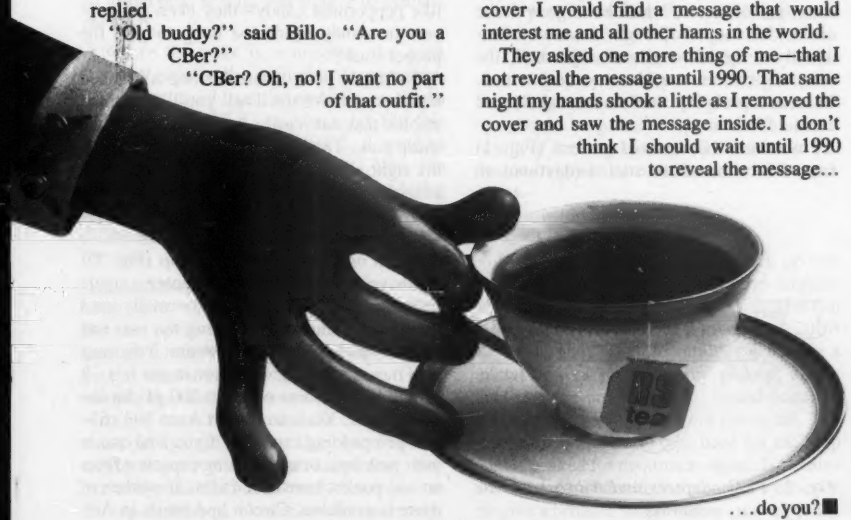
News for Hams Everywhere

I came back into the house and into the shack. The black box was still there, but for some reason I didn't expect it to be. It was now close to 5 a.m., so I went back to bed. At 6:30, the XYL woke me, and I dressed for breakfast and got ready for work. She mentioned that she hadn't slept well and had crazy dreams about strange people out in the back yard.

Three months have gone by since that memorable night. During that time I connected the Starbeam into the 830, and you can imagine the results. I call any DX station I hear, once, and I am QRP into the Starbeam. I always get 59 plus, and I have worked all countries on all bands. It has gotten so it isn't fun any more, except for the last Sunday in every month, of course.

During contact one Sunday not too long ago, I was saddened to hear from Douga and Billo that they had decided not to return to Earth for reasons they couldn't explain to me at the time. They said that the Starbeam was mine to keep, and that if I removed the top cover I would find a message that would interest me and all other hams in the world.

They asked one more thing of me—that I not reveal the message until 1990. That same night my hands shook a little as I removed the cover and saw the message inside. I don't think I should wait until 1990 to reveal the message...



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MRF422*	150W	38.00	82.00
MRF426,/A*	25W	18.00	42.00
MRF428**	150W	55.00	125.00
MRF433	12.5W	12.00	30.00
MRF435*	150W	42.00	90.00
MRF449,/A	30W	12.50	30.00
MRF450,/A	50W	14.00	31.00
MRF453,/A	60W	15.00	35.00
MRF454,/A	80W	16.00	36.00
MRF455,/A	60W	12.00	28.00
MRF458	80W	20.00	46.00
MRF460	60W	18.00	42.00
MRF464*	80W	25.00	60.00
MRF466*	40W	18.75	48.00
MRF475	12W	3.00	9.00
MRF476	3W	2.75	8.00
MRF477	40W	11.00	25.00
MRF479	15W	10.00	23.00
MRF485*	15W	6.00	15.00
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SRF2072	75W	15.00	33.00
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MRF224	40W	136-174	13.50	32.00
MRF231	3.5W	66-88	10.00	—
MRF234	25W	66-88	15.00	39.00
MRF237	4W	136-174	3.00	—
MRF238	30W	136-174	12.00	—
MRF239	30W	136-174	15.00	—
MRF240	40W	136-174	18.00	—
MRF245	80W	136-174	28.00	65.00
MRF247	75W	136-174	27.00	63.00
MRF250	50W	27-174	20.00	46.00
MRF260	5W	136-174	7.00	—
MRF261	10W	136-174	9.00	—
MRF262	15W	136-174	9.00	—
MRF264	30W	136-174	13.00	—
MRF607	1.75W	136-174	3.00	—
MRF641	15W	407-512	22.00	—
MRF644	25W	407-512	24.00	54.00
MRF646	40W	407-512	26.50	59.00
MRF648	60W	407-512	33.00	69.00
2N3866*	1W	30-200	1.25	—
2N4427	1W	136-174	1.25	—
2N5591	25W	136-174	13.50	34.00
2N5642*	20W	30-200	13.75	34.50
2N5945	4W	407-512	10.00	—
2N5946	10W	407-512	12.00	—
2N6080	4W	136-174	6.25	—
2N6081	15W	136-174	7.50	—
2N6082	25W	136-174	8.90	—
2N6083	30W	136-174	9.30	24.00
2N6084	40W	136-174	11.75	28.50

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MRF137*	30W	2-200	22.50	—
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MRF150**	150W	1.5-150	80.00	—
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The Hula Hoop Loop Revisited

Looking for relief from power-line noise? Visit your local toy shop!

Are you plagued by power-line noise on the low bands? Bothered by noise from an unknown source? There is a solution that requires no special tools or hard-to-find materials, one that could solve or greatly reduce this noise and provide you with a better signal-to-noise ratio—it's a loop antenna with an innovative twist.

Loop Antennas

Loop antennas are already familiar to many people; they've been used for direction finding on-board ships and in land stations for many years. Their construction has always been rather complex, involving the use of copper tubing as an electrostatic shield. Coax has also been used with fair results [1,2,3]. Previous emphasis has been on obtaining a figure-eight pattern using two nulls, a method that requires electrostatic shielding. Shielding the loop also helps reduce rain static noise. In short, for direction finding where you need a good null and the null direction must be accurate, shielding is a definite requirement. In terms of noise elimination, a single null is preferable; you want to eliminate interference from one direction but not reduce the signals from other directions.

Drawing on my past experience of building loop antennas for 160m before World War II (I used bicycle-wheel rims—they were wooden in those days—to support the loop wires), I began looking for an easy way to again do the same thing. It came to me that a toy called the Hula Hoop might be the answer. I purchased two Hula Hoops; one antenna I constructed with an electrostatic shield and the other without.

I made the shield by wrapping aluminum foil—the type used to repair rain gutters—around the Hula Hoop, leaving a gap at the top to prevent short-circuiting the received signal. It was a difficult task, and the final appearance wasn't very professional. When I was finished, I compared the two loops to see how well they rejected power-line noise. The rejection was about the same, but signals were slightly weaker on the shielded loop.

Because it looked better and gave a slightly better performance, I decided to go with the unshielded loop. Although it wasn't intentionally designed to give a single null, the receiving pattern turned out to be just that. This was probably due to the unbalanced coaxial feedline.

I obtained the cardioid pattern (Fig. 1) from a local broadcast station (daytime) on the upper end of the band. Although the null is quite good, I can't guarantee the accuracy of the null direction. This makes no difference if you are just trying to null a noise source.

When the project was finished, I decided to see if any articles had been written already on the subject. Sure enough, I found at least one—there may be more. W5DS wrote an article for *QST* that was published during the last sunspot minimum.[4] This article describes using a Hula Hoop and even the same aluminum foil that I used. Foiled again...but then again, I decided not to use the foil. In addition, due to its internal construction, the W5DS loop's receiving pattern was the familiar figure eight. Because the essential Hula Hoop idea has already been presented, we'll have to call this project "The Hula Hoop Loop Revisited."

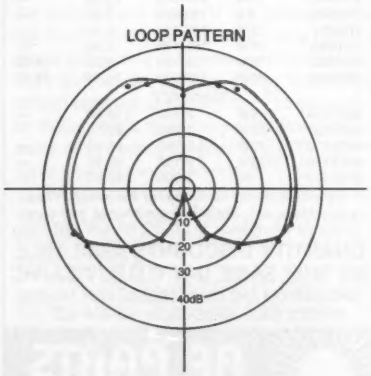


Fig. 1. The Hula Hoop Loop's receive pattern.

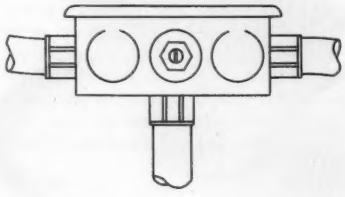


Fig. 2. PVC adapters and a breakout box make for easy mounting.

Construction

Hula Hoops are readily available in toy stores. The latest fad is to make them look like peppermint candy—they even put peppermint candy inside the hoop to give the proper smell!

To find the place where the loop is fastened together, remove the label; you'll find small staples that can easily be pried out with a sharp pick. The hoop core diameter is about the right size to fit into a PVC ½-inch end adapter. These have threads on one end and a body for the loop to fit into on the other. Using PVC cement, glue one of these adapters on each end of the hoop (Fig. 2). While you wait for it to dry, prepare a single gang electrical "handy box" normally used for wall switches by removing the two end knockouts plus one on the bottom. You must also mount a tuning capacitor in the box. It should have a value of about 300 pF for the 160m band. You can use an Arco 303 (65–365-pF) padding capacitor if you find one in your junk box, or use a tuning capacitor from an old pocket transistor radio. If neither of those is available, Circuit Specialists in Ari-

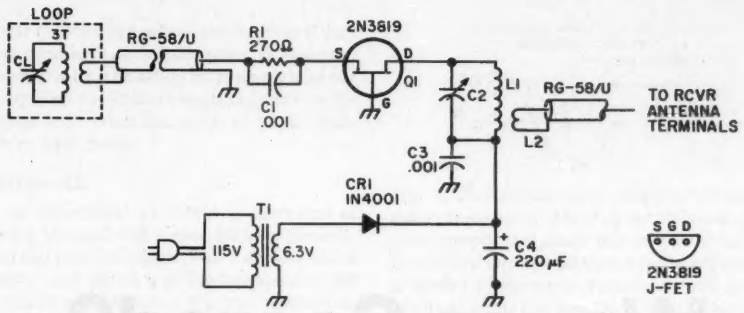


Fig. 3. This preamplifier boosts the signals back to a reasonable level. It's a simple circuit using a FET in a grounded-gate circuit that gives about 20 dB of signal gain.

zona has tuning capacitors in its catalog.[5] Naturally, the size of the hole for mounting the capacitor depends on the type.

The loop is now ready to be mounted into the box. Insert the ends into the box and secure the adapters with ½-inch locknuts of the type used for electrical conduit installations. Before locking tight, orient the hoop so it's at right angles to the box top. Once that's together, it's time to feed in the wire.

Internal Wiring

The wire used for the loop should be flexible but still stiff enough so that it won't buckle when pushed around the loop. (I used #18 AWG multi-stranded insulated wire.) If necessary, you can use a stiffer piece of wire as a fish line to pull each loop through. To prepare the wire for the loop, cut a 30-foot length and slowly start to feed it into the hoop. After the wire has been passed around three times, tape the ends temporarily to the outside of the Hula Hoop. Next, pass around another single turn of wire 10-feet in length, creating a one-turn loop. The one-turn loop will be connected to the coax. Now mount the capacitor and connect the ends of the three-turn loop to the rotor and stator. Make sure that the rotor is not grounded to the box; if it is, you'll have to insulate the shaft.

Before the coax is connected, the mast that will support the loop must be mounted. (The mast should not be metallic—a length of heavy-duty PVC can be used for this purpose.) If you do use PVC, I suggest a length no longer than 3 feet. You can use metal pipe only if there is an insulating section between it and the handy box. I've found these precautions improve the depth of the null.

Secure the mast in the same fashion as the hoop with an end adapter and locknut. Feed the coax up through the bottom of the mast or through a hole in the side of it. Pass the coax up the mast until it reaches the box. Here, connect the shield and inner conductor to the one-turn loop. Be sure that the coax doesn't short out against the box. Use tape or shrink tubing to prevent this from happening. You can now mount a blank handy-box cover to the top of the box to complete the assembly. After you check out the loop, it's wise to seal the cover and any openings with silicone adhesive.

Adjustment and Operation

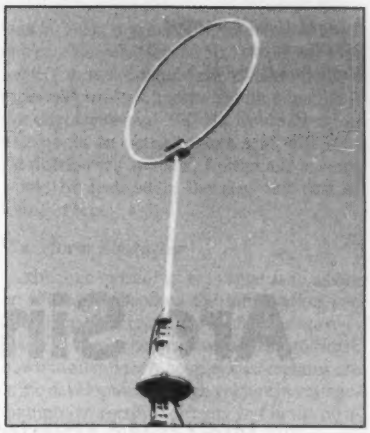
The antenna can now be connected to a receiver input for preliminary adjustments. Select the frequency you use most often and, if the noise source is available, point the loop to give maximum signal and adjust the capacitor to give maximum noise. (I did my preliminary adjustment with the loop in the shack; otherwise, it takes two people to make this adjustment.) Once adjusted, rotate the loop to give minimum noise. The loop should be approximately at right angles to the maximum position. Rotate the loop 180 degrees and only a small dip will be found.

"Signals that were unreadable because of the power-line noise are Q5 with the loop."

You'll immediately notice that the signals on the loop are weaker than on the regular receiving antenna, but the signal-to-noise ratio should be greatly improved. The bandwidth of the loop is about 60 kHz, and it will receive signals across the entire 160-meter band.

Preamplifier

In order to boost the signals back up to a reasonable level, I constructed a pre- amplifier (Fig. 3). It's a simple circuit using a FET in a grounded-gate circuit that gives about 20 dB of signal gain. The preamplifier is built in a metal box to prevent stray pickup, and it includes the power supply. I used coax fittings to bring in and take out the signal. The capacitor is the same type used for the loop and is peaked for maximum signal. It can also be stagger-tuned with the resonant frequency to give a broader bandwidth.



If you suffer from power-line noise, the solution to your problem may lie in a simple Hula Hoop.

Using the loop, I have found that signals that were unreadable because of the power-line noise are Q5 with the loop. The loop directivity has little or no effect on sky-wave signals and therefore can be set on the noise source and left there, providing the noise is always from the same direction. This project should cost less than $15, including the preamp. It's simple enough that no one should have difficulty in its construction. Although I haven't tried it, you should also be able to use the loop on 75 with fewer turns; since there is ample room, it can possibly work on 160 kHz with additional turns.

By the way, the power company has since replaced the transformer that was causing my noise problem, but there is still some residual noise, which is easily nulled out. ■

References

1. "Loop Antennas," John R. True W4DQ, *Ham Radio*, December, 1976.
2. *The Low Frequency and Medium Frequency Radio Scrap Book*, Ken Cornell W2IMB.
3. *ARRL Antenna Handbook*.
4. "The W5DS Hula Hoop Loop," Bob Edmund W5DS, *QST*, October, 1975.
5. Circuits Specialists Co., PO Box 3047, Scottsdale AZ 85257.

Parts List

R1	270Ω ¼W	271-1314
C1, C3	.001 µF ceramic	272-126
C2	300 pF variable	
C4	220 µF 16V electrolytic	272-1006
CR1	1N4001	276-1101
T1	6.3-V secondary	273-1384
L1	100-µH choke	273-102
L2	10 turns around cold end of L1	
Q1	2N3819	216-2035
	RG-58/U	278-1326

Irving M. Gottlieb W6HDM
931 Olive Street
Menlo Park CA 94025

Are Sine Waves Sacred?

W6HDM thinks not and gives a convincing argument for abandoning 60-Hz ac.

Our perceptions of the world around us, naturally enough, can lead us to the assumption that *other* formats, *other* procedures, and *other* viewpoints than ours can justifiably be relegated to oblivion, deserving no further consideration. Take that nice sine wave pictured in Fig. 1(a) that the utility endeavors to pipe into our home or workplace. Since Edison's pioneering work in power generation and distribution, virtually no further protest has been heard against the use of sine waves or ac in general. Of course, Edison—not withstanding his brilliant record as an inventor—committed the intellectual faux pas of rejecting ac altogether; he didn't understand the mathematics involved.

It has been about a century since Edison's desire for dc was overruled, and the world has become crisscrossed by a vast network of ac power lines. Would one dare suggest, at this late date, that some *other* waveform than the sinusoid might be more suitable for the transmission, distribution, and consumption of electric power? Such, indeed, is the gist of this article, and the reader is invited to judge whether such a suggestion smacks of boldness or recklessness—or perhaps of something in between.

At the very outset, remember that whatever beauty the sine wave was endowed with at the generator is generally conspicuous by its absence by the time it gets to your wall socket. In many cases, it is likely to resemble the harmonic- and transient-ridden wave depicted in Fig. 1(b). This comes about via thousands of SCRs and other solid-state power devices, motors, nonlinear loads, reactance, arcs, sparks and faulty contacts, storm-induced currents, etc. The idealized sine wave of the textbooks, with only its fundamental frequency and no transients or noise, is *not* what we plug into.

This situation is food for thought—if such a messed-up *former* sine wave is what we usually get in actual practice, it might indeed be advantageous to start out with some *other* waveform. Even assuming that another type of wave would also be subject to the brutalities inflicted on the sine wave, the overall situation resulting just might exhibit some desirable features! And if the vested interests in the status quo are too strong for a change in the way our large cities are powered, maybe our new waveform can still give a good account of itself in isolated communities, on shipboard, or in space vehicles.

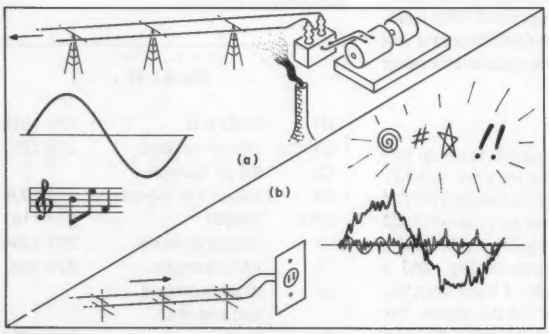


Fig. 1. The sine wave from the utility is esthetically pristine and electrically "pure," but alas, corruption has set in by the time the power reaches our wall socket.

Admittedly, fantasy can ensue from that kind of thinking. It will prove profitable, however, to bear in mind that imaginary scenarios often are invested with more than a mere modicum of truth. We knew all the time, did we not, that Dick Tracy's wrist transceiver was just around the corner? And did not the space weapons of Buck Rogers make sense just because we sensed their imminent appearance?

The nature of the fantasy in which we will immerse ourselves here is simply the pretense that Thomas Edison mostly *did* get his way and that most of present-day electric-power transmission and distribution *is* dc and not ac. (Surely, you will recall that Edison did not like ac because volts, Amps, and Watts often did not add up properly in a distribution system when tallied with common sense arithmetic; and there were others accomplished in the electrical technology of the day who also frowned upon the violation of Ohm's "law" in ac circuits.)

So, here we are. It is 1986, and (we pretend) dc is the fashion of the day. There is, however, much ferment and controversy because several of the more progressive utilities have wired up isolated towns and communities with ac distribution! They have demonstrated beyond reasonable doubt that ac systems are much more flexible and versatile—thanks to the use of transformers—than dc systems! Moreover, by using 60-Hz sine-wave generation, they have shown the path to greatly-upgraded industrial processes via the induction motor!

Whether formulated in so many words or not, the burning question in our pretend world is: What shall be the future format of electric power distribution, ac or dc? And if ac, what frequency and waveform? It is universally conceded that 60-Hz sine waves make much sense, but there are contenders and lobbies for other ac parameters, too.

In particular, a think tank formed by a group of overaged, unemployed engineers has advanced compelling arguments for a standardized generation and distribution format using 100-Hz near-square or trapezoidal waves. Inasmuch as some of these industry-rejects are hams, it would behoove us to give

their theories due consideration (even if they are seemingly on the wild side). In so doing, we will at least be acting more wisely than our corporations, which relegate engineers to the scrap heap when the blush of youth fades from their cheeks.

Trapezoids

A *trapezoidal* waveform is advocated as being invested with a good blend of theoretical and practical pluses. Fig. 2 depicts such a wave, and shows it to be composed of the fundamental frequency plus two harmonics, 3f and 5f. This, of course, is old hat to those of us acquainted with the Fourier theorum of wave composition. (An interesting aside is that the fundamental frequency has greater amplitude than the composite trapezoidal wave; this is not a draftsman's boo-boo and will be dealt with later.)

Right off the bat, our curiosity is aroused with regard to the trapezoidal waveform. If one is to go in this direction—toward harmonic-rich waves—why not just select a nice 50%-duty-cycle *square* wave and be done with it? In answer to this very natural question, the august body of practical scientists of the think tank replies that the square wave was, indeed, their first consideration. It was, however, quickly and clearly evident that true square waves, or even "practical" square waves, were possessed of two overwhelming disadvantages. First, it would be impractical to try to generate, transmit, and distribute square waves because reactive loads and stray reactances would play havoc with the high-frequency components of such waves, thereby distorting their shape in unpredictable ways. Second, square waves, as is shown in Fig. 3(a), contain numerous high-frequency harmonics which would create interference with radio, TV, and with communications systems in general.

Assuming that the square wave would be otherwise still worthy of consideration, Fig. 3 also confirms something of relevancy. This is that a near-square wave can be formed from just a few harmonics. Thus, in Fig. 3(b) we see a trapezoidal wave essentially made up of four harmonics, 3f, 5f, 7f, and 9f. Instead of many hundreds or many thousands of higher frequency components, this waveform can be tailored to carry no more than four or so. It can be appreciated that if we allowed, say, ten harmonics, the waveform for certain practical purposes would be square but without power to create radio and communications interference. This, it is contended, is a fortuitous phenomenon inasmuch as steep-rise and -fall square waves are not practical to distribute and feed to loads anyway. It is true that nothing yet has been cited to justify consideration for such a compromise square wave. Accordingly, let's see what the behavior of such a waveform might be and how it stacks up with the sine wave. (And most important, let's make the comparison in terms of things which exist in actual practice.)

New Waveform Needs

A natural question is, why the sudden interest in square-wave power? Why bring up a non-sinusoidal waveshape now? After all, practical electrical technology has been more than three quarters of a century in the making. Surely the virtues of other than sine waves would not have escaped consideration during this long evolutionary period.

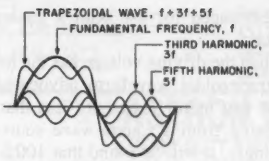


Fig. 2. Trapezoidal wave composed of just three frequencies. The Fourier theorem of wave composition states that any wave may be resolved into a fundamental frequency and a number of harmonic frequencies with appropriate phase and amplitude relationships.

Indeed, the knowledge was there, even at the turn of the century. However, two things were lacking until relatively recently. First, the need for a better waveshape did not manifest itself for a long time. As long as the primary type of load was incandescent lighting and the user of electric power received a fairly good sine wave, no case could be made for another waveform. Second, the processing equipment for forming and transmitting near-square waves evolved with the advent of semiconductor power devices, especially the SCR. Previous methods for doing this were neither economically nor technologically suitable. Also, earlier core materials would have exhibited objectionable losses if subjected to low audio frequencies residing in a trapezoidal wave. Today, however, transformers are both feasible and cost-effective for manipulating 100-Hz trapezoidal-wave power.

Admittedly, if your utility suddenly switched over to 100-Hz trapezoidal power, there would be some difficulties, perhaps even some malpractice suits! For one thing, electric clocks would run too fast, by the ratio of 100:60. So, too, would all 60-Hz induction motors. (This might cause your washing machine or dishwasher to work better than ever, but I will not belabor this point!) Note, however, that the motors overspeed because of the postulated 100-Hz line frequency, *not* because of the new waveshape.

This gets us into an interesting topic—the behavior of motors on non-sinusoidal waves. Fortunately, a good deal of practical experience has been accrued in this area because of the electronic generation of square waves. The simple saturable-core, two-transistor inverter is a classical example of a square-wave power source. Also, SCRs have been much used in higher-power versions. There is much interest right now in motor operation from inverters because of solar- and wind-powered units for homes (as shown in Fig. 4). Here, again, we find ourselves in a situation which did not exist to any great extent until the commercialization of solid-state power devices.

There are several reasons why 100 rather than 60 Hz is suggested for trapezoidal-wave power. Many feel that 60 Hz is marginal with respect to eye fatigue from flicker. This is especially true for fluorescent illumination—ask any draftsman! 100 Hz would blend in nicely with the metric system. And, with 100-Hz distribution systems, worthwhile savings would be realized in the size and cost of transformers.

Waveform Character

Although most of us are vague as to where or when we absorbed the information, we know that the peak value of the sine wave is not very useful beyond its capacity to break down insulation. (A couple of exceptions are in the development of high voltage in voltage-multiplying rectifier circuits and in the turn-on impulse of fluorescent lamps.) What generally gets the job done in electrical loads is the rms value of the sine wave, and this is only approximately 70% of the peak value. In motors and in other electromagnetic devices, usefulness of the peak is even less because it is the average value that does the work. The average value of the sine wave is only about 64% of the peak value. In sharp contrast, the peak, rms, and average values of a square wave are the same! For practical purposes, this remains true for a trapezoidal wave with about seven or more harmonics.

It is easy enough to see that the trapezoidal wave has some of the desirable features of square waves, and without the interference-prone higher harmonics. And it certainly is going to be kinder to transformer and motor insulation, to rectifiers, and to filter capacitors than sine waves! Also, certain instrumentation and computations could be less confusing with trapezoidal than with sine waves.

The close resemblance to, and the easy derivation from square waves suggests that the low-level manipulation of trapezoidal waves can be accomplished readily with digital-logic circuitry. Such manipulation can include power-factor correction and the generation of polyphase formats. These and other techniques stem from the precision of logic circuits in timing applications.

One reason that the trapezoidal wave tends to be benign to apparatus originally intended for sine-wave operation is that these waveforms are not drastically different in their composition; neither has any dc component or even-harmonic energy; actually, the harmonic constituency of the "wall-socket" sine wave and the limited-harmonic trapezoidal wave can be surprisingly similar. By appropriately tailoring the amplitudes and phases of some wall-socket sine waves, you could form a trapezoidal-like waveform. (In other words, what started out as a pure sine wave reaches us quite distorted with third, fifth, and higher harmonics.) From the use of solid-state inverters, we know that many kinds of electrical loads have been successfully operated from square waves. It would be natural to anticipate even better results from trapezoidal-wave power.

Note from Fig. 2 that the sine-wave component of a square or trapezoidal wave actual-

ly has a higher peak value than the composite wave itself. This, of course, is not visible on an oscilloscope, which shows only the *envelope* of the composite wave. One must perform a Fourier analysis or plot the graphical composition of the harmonics to appreciate this.

Now, it appears that because the peak of the sine-wave fundamental is considerably greater than that of the composite square wave, the rms value of the sine wave is greater than that of the composite square wave. This, however, is not so. Actually, it turns out that the rms value of the fundamental sine wave is about ten percent *less* than the rms value of the composite square wave of which it is a part. What this means is that a square wave should have an rms value ten percent *greater* than the rated rms sine-wave voltage stamped on the nameplate of the motor.

Although no mathematics was used in arriving at this conclusion, it naturally follows from the Fourier theorem and from the relationships of peak and rms voltages in waveforms. It is well known, however, that inverters used for driving motors often do not impress 110% of rated sine-wave voltage on the motor; indeed, it is more like 90% in practice. The reason for this is that many motors would develop excessive temperature rise from a 110% square wave due to increased losses from eddy currents and hysteresis. For, even though the inductance of the motor or of an external inductor strips higher harmonics from the current waveform, these harmonics in the voltage waveform still can cause added dissipation in the motor. It is not difficult to design the motor to minimize such losses, but as we know, most 60-Hz motors were not envisaged for use with a square-wave source.

When the driving voltage has the nature of the trapezoidal waveform advocated, it is found that motor losses are less than when operating from a square-wave source. Accordingly, it will be found that 100% of the sine-wave rated voltage can be applied. (Incidentally, many of the "true" rms digital multimeters are just what the doctor ordered for measuring the rms value of low-frequency trapezoidal waves!)

Recapitulating, ac motors driven from a trapezoidal-wave source tend to develop near-optimum performance. This is because either self-inductance or external inductance causes the torque-developing motor current to be nearly sinusoidal, and because the trapezoidal voltage waveform is devoid of the higher harmonics present in a square wave. It is, of course, true that the strong third, fifth, and seventh harmonics in a trapezoidal wave still can degrade the efficiency of the motor; practical experience seems to indicate that most 60-Hz motors don't fare too badly.

Interference

It is common knowledge that a pure sine wave contains no harmonic frequencies above the fundamental and is, therefore, unlikely to interfere with radio-frequency systems. It is also recognized that the ideal square wave is capable of providing a spectrum of harmonic frequencies covering all communications services from low-frequency systems to millimeter equipment. Indeed, even the ordinarily-encountered, "practical" square waves, such as are produced in switching power supplies, can blanket many communications bands with severe noise interference. This suggests that sine waves are the good guys and square waves are the bad guys. However, it has been pointed out already that the nice sine wave is a textbook entity not too often encountered at the wall socket. The distortions that characterize the voltage and current waveforms of utility power as well as the transients and noise that come along for the ride create numerous problems in communications gear and in computer equipment.

Inasmuch as the practical sine wave has tarnished credentials and the practical square wave never had any, the trapezoidal wave with a few allowed harmonics begins to appear in a more favorable light. It remains to be shown that such a wave is at least as satisfactory as the sine wave for power purposes. To be sure, it will also be messed up at the wall socket. However, such a wave might be easier to clean up than a transient-laden sine wave. This is because its nearly flat top would allow more effective use of transient-clipping devices such as back-to-back zeners, MOVs, or similar devices. Interesting, too, is the fact that a little rudimentary filtering imparted to a trapezoidal wave readily yields a near sine wave of better quality than we are accustomed to monitor now at our wall sockets!

Electric Shock Hazard

Tissue damage and heart fibrillation are very much a product of the amount of current passing through the body. At moderate voltages—those likely to be encountered at home or at work, i.e., 120 or 240 volts—the initial contact resistance of the skin figures predominantly as the current-limiting mechanism in most accidental contacts with the power line. If you are destined to be shocked by a 120-volt line, it would be better, other things being equal, to be subjected to a trapezoidal wave than a sine wave. The reason is that the peak voltage of the sine-wave line is about 170 volts compared to the approximately 120 volts of the trapezoidal line. It is likely that 170 volts will establish a lower resistance contact with the skin than 120 volts, at least during brief accidental shocks. Although we are in a somewhat controversial area here, it does appear that the high peak of the sine wave increases the danger from a momentary shock.

Corona

A considerable power loss occurs in high-voltage transmission lines due to ionization of the air, or corona. Among other parameters,

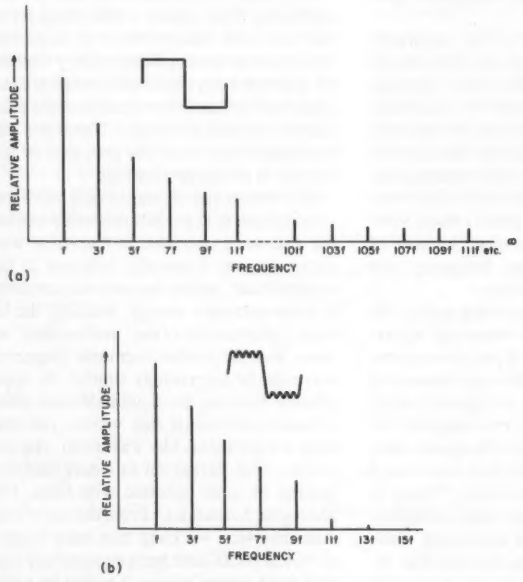


Fig. 3. The harmonic spectra of square and trapezoidal waves. (a) Harmonics in a square wave—the harmonic frequencies go on forever (or almost). (b) Harmonics in a trapezoidal wave—a limited number of harmonics suffices.

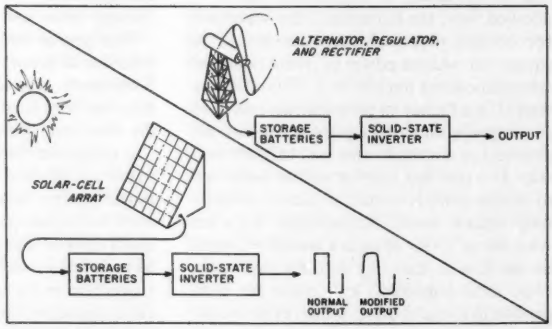


Fig. 4. Trapezoidal waves are readily obtainable from alternate-energy systems. The square-wave output from inverters is easily modified into the more benign trapezoidal shape.

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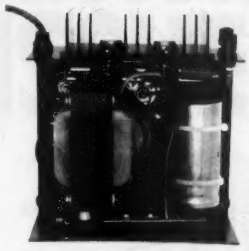

INSIDE VIEW – RS-12A

RS and VS SERIES

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output.
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-4A.
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- RIPPLE: Less than 5mv peak to peak (full load & low line)

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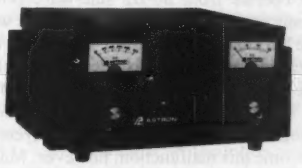
MODEL RS-50M



MODEL VS-50M

RM-A Series

MODEL RM-35A

19" X 5¼ RACK MOUNT POWER SUPPLIES

Model	Continuous Duty (AMPS)	ICS* (AMPS)	Size (IN) HXWXD	Shipping Wt. (lbs.)
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• SEPARATE VOLT & AMP METERS				
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W X D	Shipping Wt (lbs)
RS-4A	3	4	3¾ x 6½ x 9	5
RS-7A	5	7	3¾ x 6½ x 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 x 7½ x 10¾	11
RS-12A	9	12	4½ x 8 x 9	13
RS-20A	16	20	5 x 9 x 10½	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13¾ x 11	46

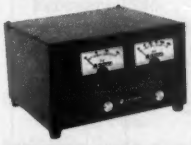
RS-M SERIES

MODEL RS-35M

• Switchable volt and Amp meter

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt (lbs)
RS-12M	9	12	4½ x 8 x 9	13
RS-20M	16	20	5 x 9 x 10½	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13¾ x 11	46

VS-M SERIES

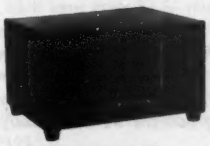


MODEL VS-20M

- Seperate Volt and Amp Meters
- Output Voltage adjustable from 2-15 volts
- Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt (lbs)
VS-20M	16	9	4	20	5 x 9 x 10½	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13¾ x 11	46

RS-S SERIES



MODEL RS-12S

• Built in speaker

MODEL	Continous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt (lbs)
RS-7S	5	7	4 x 7½ x 10¾	10
RS-10S	7.5	10	4 x 7½ x 10¾	12
RS-10L(For LTR)	7.5	10	4 × 9 × 13	13
RS-12S	9	12	4½ x 8 x 9	13
RS-20S	16	20	5 x 9 x 10½	18

corona loss is a function of voltage. Inasmuch as the peak voltage of a sine wave is about 40% higher than that of a trapezoidal wave having the same rms voltage, it would appear that more efficient transmission of electric power could be expected with the trapezoidal than with the sine wave. At the same time, QRM from the corona should also show a worthwhile reduction. A similar argument prevails for the sparking and arcing across leakage paths of high-voltage insulators: the less peak voltage, the better.

Fluorescent Lamps

Both the use of the trapezoidal wave and an increase in frequency to 100 Hz would tend to produce a steadier light from fluorescent lamps. Some fluorescent-lamp circuits that now operate from 60-Hz sine-wave power probably would not start if nothing else were done but changing the power-line format to a trapezoidal wave. This is because sufficient peak voltage would not be available during the start phase of operation. Various strategems could be used to circumvent or overcome this malfunction, however. Manufacturers would likely market a special ballast inductor or transformer for the purpose. A number of purely electronic techniques might also be employed in which a momentary transient of high voltage could be developed. In any event, the design of new or replacement fixtures for accomplishing the purpose would not present any severe technical or cost problems. And once trapezoidal-wave power became fairly commonplace, there is little doubt that the fluorescent lamps themselves would be optimized for reliable starting at the lower peak voltage associated with the new waveform.

Trapezoids and Dc Power

A wide spectrum of electronic equipment makes use of power supplies which rectify and filter the ac from the utility. For a long time, virtually all such supplies used an isolation or power transformer. In any event, such transformers operate just about as well from a trapezoidal wave as from a sine wave, although the mathematics of design would not be quite the same if one decided to dedicate the transformer for a specific waveform. Although square waves would introduce some problems, the trapezoidal wave can be expected to be completely acceptable to transformers, especially if any reasonable safety factor was incorporated in the original design. The design of new transformers to accommodate the trapezoidal waveform certainly would present no problems.

The rectifier elements would be spared the necessity of being rated to withstand peak voltages appreciably higher than average or rms, as is the case with sine waves. The rectifier elements "see" the envelope of the trapezoidal wave, just as on the oscilloscope. This is fortuitous because the rms, average, and peak voltage in a trapezoidal wave are nearly identical.

Note that the high peak of the fundamental component as shown in Fig. 2 is not experienced by the rectifier elements. As previously stated, only the envelope of the composite wave manifests itself insofar as peak voltages are concerned. Although this may be of small consequence in low-power equipment, it has very favorable electrical and economic significance in the design of high-voltage power supplies which are called upon to provide appreciable power as well.

Another advantage of the trapezoidal wave is in the residual ripple following rectification. Simply stated, less filtering is needed than for sine-wave operation of the supply. And, unlike square-wave operation, there is much less trouble with electrolytic capacitors that do not function well at high-ripple frequencies. Similarly, because there is almost negligible harmonic energy at high-ripple frequencies, filter chokes can do their job without being bypassed for high frequencies by stray capacitance.

It may be argued that some supplies, such as voltage multipliers which depend upon peak voltages to develop their high voltage, would not deliver expected voltage. This contention is valid for no load or for very light load. But if any appreciable current is required, the improved regulation which will result with the trapezoidal wave would be a compelling feature (see Fig. 5). Regulation is improved because there is less "dead time" between rectified pulses.

All things considered, my proposed trapezoidal wave should be very kind to electronic power supplies!

Trapezoids and Electric Motors

Square-wave operation of motors is a mixed bag. On the one hand, induction and synchronous motors don't like the square waveform; the harmonics therein contain increased eddy-current and hysteresis losses. These harmonics often develop countertorques that interfere with smooth operation and sometimes inhibit self-starting. However, the self-inductance of such motors often comes to the rescue by attenuating much of the harmonic energy, thereby making the waveform of the motor *current* near-sinusoidal, or approximately trapezoidal. Whether or not adverse operation will be experienced depends to a great extent upon the design and construction of the motor. If the self-inductance is relatively high and if thin laminations of quality-grade motor steel are used, the motor is very likely to start and run normally. Also, it is generally feasible to insert a small inductance in series with the motor to provide the small amount of filtering needed for satisfactory performance. In any

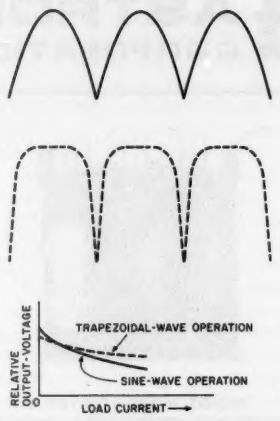


Fig. 5. Dc power-supply behavior for sine and trapezoidal waveforms. Top: full-wave rectification with a sine-wave. Center: full-wave rectification with a trapezoidal wave. Filter capacitors have more time to charge and are allowed less time to discharge. Bottom: general form of regulation curves. Note higher light-load voltage for sine-wave operation—this might be of significance in certain applications of voltage-multiplier circuits. For most applications, the better regulation of the trapezoidal-wave operation would be considered advantageous.

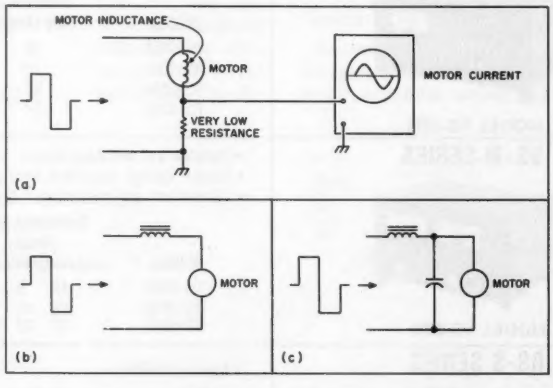


Fig. 6. The rationale for trapezoidal-wave operation of ac motors. (a) Setup for monitoring motor current reveals that it tends to be trapezoidal even though square-wave voltage is applied to motor. (b) Instead of relying upon motor inductance to strip higher harmonics from the square wave, a small external inductor can be used. (c) For small ac motors, an L-section low-pass filter can be a cost-effective way of ensuring that the motor actually "sees" a near-sinusoidal or trapezoidal wave.

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event, it is motor *current* that produces the turning torque, not motor voltage.

If, however, we start out with a trapezoidal wave, the chances are enhanced that most motors will behave well. The third and fifth harmonics of such a wave many still interfere with certain small motors, but here again a small inductance connected in the line tends to alleviate trouble. Moreover, with small motors it is cost-effective to use an L- or pi-section low-pass filter in the line for even better attenuation of harmonic energy.

Series motors, otherwise known as universal or ac-dc motors, also run well from square waves and may even develop improved torque characteristics. Sometimes, depending upon a number of motor-design features, commutation problems may be experienced in the form of excessive sparking. This can usually be remedied by connecting a capacitor across the armature. Here again, less trouble is likely if one starts out with a trapezoidal rather than a good square wave. Added insight into these matters is provided by Fig. 6.

The situation with regard to the voltage that should be applied to a motor operating from non-sinusoidal power has already been alluded to. Additional insight is readily attained by consideration of the nature of the good square wave. One then can closely approximate the situation prevailing for the near square wave or trapezoidal wave. Recall that the rms, average, and peak values of the square wave are one and the same, and note the fact that it is the sine-wave fundamental component of the square wave which actually develops the electromagnetic torque in a motor. The harmonics can be considered to come along for the ride on the impressed waveform but do not figure prominently in motor operation (except for the alluded-to tendency to somewhat increase dissipative losses).

Conclusion

This plain-language discussion has endeavored to show that a trapezoidal wave with a limited number of harmonics manifests the salient advantages of both the sine wave and the square wave. At the same time, the proposed trapezoidal wave does not have some of the drawbacks of either sine or square waves. In presenting the case for trapezoidal waves for power lines, it was also pointed out that our present utility power techniques often fail to deliver a really good sine wave at the wall socket. This being the situation, certain arguments for sine waves fall by the wayside in actual practice.

It is well known that professionals and bureaucrats have notoriously missed the boat in past considerations of technical innovations. Also, it is a feather in the ham's cap that amateur radio often has been the source of new and exciting ideas that have resulted in widespread implementations of them. This being true, OM, would you welcome the trapezoid into your ham shack? ■

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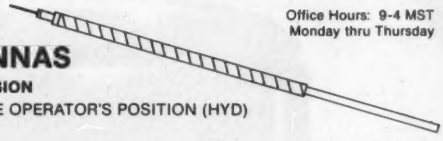

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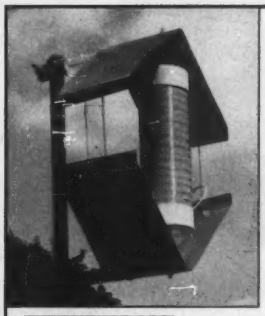

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Transmitter Hunters: Here's Your Ammo For Tracking

For the serious competitor—spend a few evenings with a soldering iron and get the jump on the pack.

A short while ago the age old pastime of transmitter hunting was revived here in Omaha. There have been a number of enthusiastic hunters, but they have discovered that there is a great lack of decent direction-finding equipment.

There were only two of us who could track with any ease. I had a spectrum analyzer hooked up for mobile operation and Bill WA9ASD, a transplant from Chicago, used to be a very active hunter there, but he had become a bit rusty.

Photo A. Inside this rf-proof can lurks a Tempo S-1 HT.

Most everyone else had thrown together pads, antennas, and other hurriedly assembled paraphernalia in anticipation of having a good time. As it turned out, everyone had a lot of fun and the equipment is improving both in type and application.

I quickly found that the spectrum analyzer is great for getting to the rabbit fast, but is not what one would call portable. I had visions of carrying the inverter and a car battery in a backpack, should the rabbit be in the middle of a field somewhere.

I did have a Tempo S-1, but it did not have an S-meter. I had gone over it very carefully before to see if there was some way to put a meter on it. The answer was still no (at least not with just a meter movement). I wondered how difficult it would be to use an external i-f and meter circuit to do the job. After a little testing, I discovered that the output of the second mixer seemed to have a very wide dynamic range. Looking at it (455 kHz) on the spectrum analyzer and increasing the rf at the antenna, the signal was discernible from about .7 microvolts and tracked linearly up to about 5,000 microvolts, nearly an 80-dB range. 5,000 microvolts was roughly the gain compression point at the output of the mixer at 455 kHz. It looked like a good possibility.

I tried several circuits to do the job with varying degrees of success. The one that finally worked was a CA3089E in a circuit stripped down from its intended use. The IC itself has lots of gain, limits at about 12 microvolts, and has a metering pin that follows input level not quite logarithmically from about 1 microvolt up to about 3,000 microvolts (about a 70-dB range). The result is the circuit in Fig. 1. All of the three models built and tested have a range of 0–70 dB when using a 0–1-milliamp meter movement. So it follows that one should need only a single-step 50-dB attenuator to give 120 dB of range. This is, in fact, the case.

When one is operating at the high end of

this range a new set of problems occur—not with the electronics but with the plastic case of the S-1. One just can't be sure whether the signal is coming from the directional antenna or through the case of the radio. This is a common problem on any transmitter hunt.

Since the S-1 is of a modest size, it fits easily into a one-gallon paint can. With the paint buffed off of the lid where it seals, and off of the bottom cover seal, and the can soldered shut (my brand new paint can had a primer coat inside and the bottom was only a paint gasket seal), I could key up with 10 Watts at two inches from the can and the S-1 didn't even know it was there. The rubber duck was elbowed over against the S-1 with two BNC elbows.

That was good enough rf integrity for me. Maintaining this integrity when adding meters, switches, and BNC connectors has to be done with some care and forethought. The first hole I drilled in the can was for a BNC soldered to the lid. I again tested the rf integrity and found that 10 Watts at two inches was *full* quieting. I put a BNC cap over the newly installed connector and was back to full integrity. The 0.5-pF (or so) capacitance between the BNC's center pin and free space was enough antenna to give a full quieting signal with 10 Watts at two inches.

Next, the meter movement: I used a double-wall construction for this (see photos) and a .001 feedthrough. This passed the "10 Watts at two inches" test the first time.

Third was a three-pole, double-throw toggle switch for the 50-dB attenuator mounted next to the BNC on the lid and shielded. The center pole is grounded at all three terminals to prevent capacitive coupling between In and Out. A two-pole switch gave only 41 dB with the 10k removed (see Fig. 2).

Mounting the meter board, the 12-V regulator, the 9-V batteries (explained later), the power switch for the metering circuit, and meter multiplier switch posed no problem. However, adding an LED as a power-on indicator did. The capacitance of the metal in the diode with free space was enough to fail the "10 Watts at two inches" test easily. Two .01-uF capacitors with very short leads soldered between each LED lead and the can cured the leak.

I did add one more hole to the lid. I had a hard time hearing the S-1 with the cover on if there was much ambient noise, even at full volume. An external speaker seemed in order.

I punched a 1½" hole in the lid and soldered a layer of copper window screen (about 1/16" mesh) inside to reseal it for rf and added the speaker. It failed the "10 Watts at two inches" test miserably! A second layer of screen outside with the center insulated by a Teflon™ washer and meshed at 45 degrees to the original restored the rf integrity (see Fig. 5). The only things left to do were cosmetic.

One may wonder why the concern about rf integrity. If one is certain that the only rf getting to the radio is through the BNC connector on the top of the can, one can also be sure that the indications will be solely those coming in the antenna of choice.

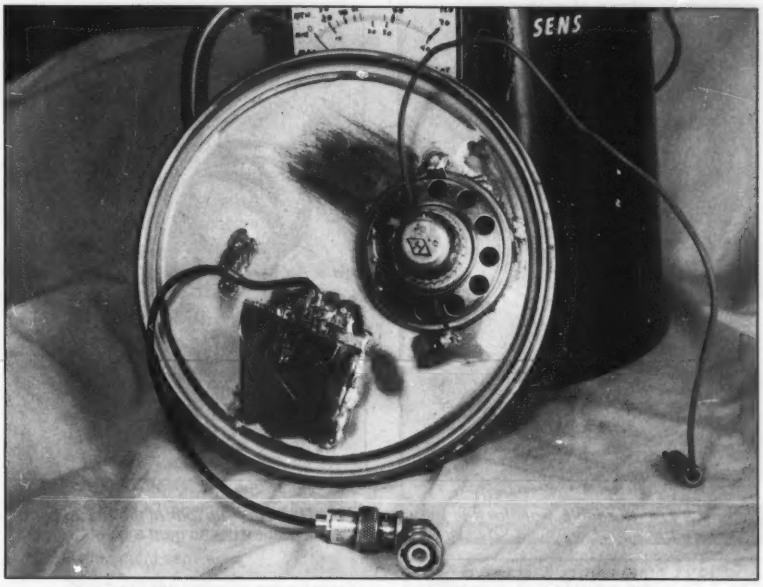

Photo B. Buff the lid around the rim and wherever you plan to solder.

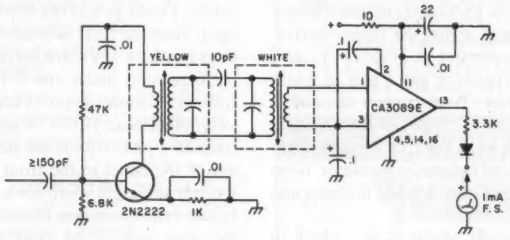

Fig. 1. Schematic diagram.

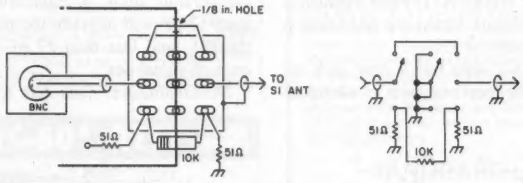

Fig. 2. Toggle switch for the 50-dB attenuator.

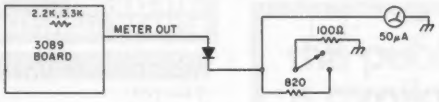

Fig. 3. Optional meter circuit for DFing weak signals.

Board Construction

Component layout is shown in Fig. 6 and the foil-side positive is shown in Fig. 7. The two .1-uF capacitors and the 22-uF capacitor must be tantalums to ensure that oscillation does not occur.

The two i-f cans are scavenged from an old AM superhet transistor radio. The transformers with the yellow core and the white core are used. There will also be a black- and a red-core transformer that are not used. One of these radios can be procured from a friend or neighbor who has an old one (if you don't). Chances are slim the transformers are bad if the radio is in good mechanical shape.

When construction is finished, tune-up is simple. Tune the S-1 to a weak station that is just barely full quieting and tune both transformers for a maximum meter reading.

An optional meter multiplier circuit is shown in Fig. 3 and is about 40 dB full scale in its most sensitive position. This lets one get a fix on a weak, distant station more easily.

Photo C. Use a double wall for the meter mount.

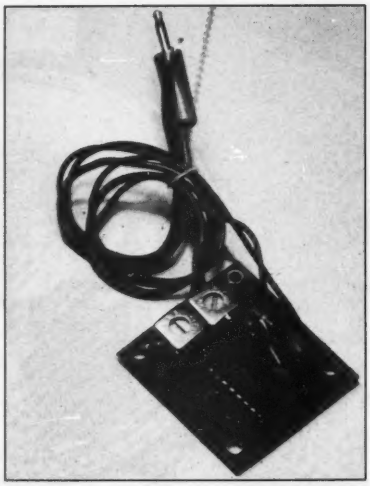

Photo D. A close-up look at the circuit board.

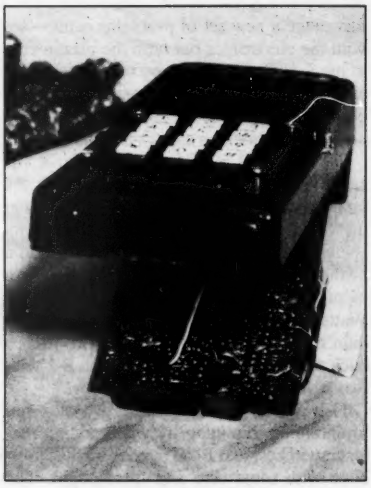

Photo E. Mount the subminiature jack on the bottom right corner of the case.

The 3.3k output resistor was changed to a 2.2k resistor for this circuit.

A few final thoughts—the IC is designed for about 12 V (8–15 V) and current is nearly constant at 22 mA across the range. Performance seems optimum at 10.5–14 V, so I used a 12-volt regulator and a pair of 9-volt batteries in series. Total current demand is about 23 mA, so a couple of the cheapest batteries should work for 2 or 3 hunts. They can get pretty dead before the regulator drops out and the IC gets to its 8-volt minimum and quits.

There is a nearly identical IC, *which in most other applications is a better chip* but has only about 30–35 dB of range on its metered output. It is a CA3189 and *should not be used in this circuit.* I tried one and found it most unsatisfactory.

My Tempo S-2 also has a new jack on its side and the performance is identical except for the antennas one must use.

The power supply is shown in Fig. 4. The 12-V regulator can be any one of the 78X12 series. I used an LM78L12ACH (TO5 package). Note the LED is in series with Vcc and does not draw any extra current.

Connection inside the S-1 and S-2 is as follows: Connect approximately 5 inches of very small coax (RG-174 will do) to a subminiature jack. Mount the jack near the corner of the bevel in the front of the case, as there is sufficient room for a small jack here but no extra space (see Photo C). Next, dress the other end of the coax and connect as shown in detail of the S-1 board (same on S-2). The actual connection is the input pin on the ceramic filter. A capacitor much larger than 47 pF will degrade the performance of the S-1, and less than 22 pF won't couple enough signal out.

Disadvantages: One has to pop the lid every time one needs to adjust the S-1's controls or change frequency and there is, of course, no push-to-talk operation while DF-ing. But, then, one doesn't need that much anyway.

Advantages: Portable, very wide range meter (70 dB—most FM S-meters have only a 20–30-dB range or one has to guess at lights), a cheap addition to an existing radio, and it will work with any radio with a 455 i-f and a discrete mixer.

A footnote: This circuit has been used on the ICOM 4AT, a Regency business-band UHF radio, and a Standard C118. They all needed some isolation to work properly. In all cases the only convenient point to pick off the 455-kHz signal had sufficient baseband noise that the meter gave a substantial reading even with no signal input. The cure was a resistor in series with the 47-pF capacitor in the radio. In the Regency, the optimum value turned out to be 100k; in the ICOM, 47k; in the Standard, 10k.

The ICOM has only about 50 dB of range because it limits in the IC at a lower point than in the S1. The Regency has about the same 70-dB range as the S1, and the Standard also has about a 50-dB range.

To find the proper value of series resistance

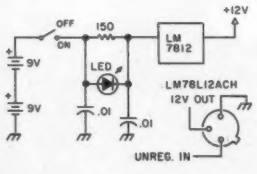

Fig. 4. Power supply.

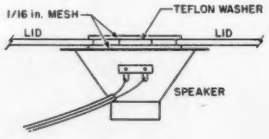

Fig. 5. Two layers of mesh are necessary for rf integrity.

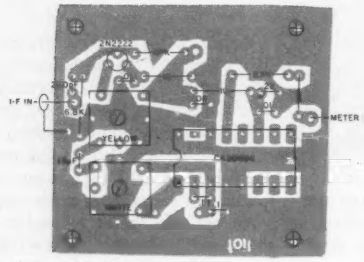

Fig. 6. Component placement.

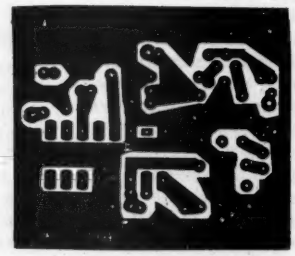

Fig. 7. PC board, foil side.

necessary, place a 1-megohm pot in series with the 47-pF capacitor. Adjust the pot until the meter barely reads with no signal input. Then measure with an ohmmeter and put in a fixed value as close to the measured value as possible. 10% tolerance is sufficient (52k was measured on the ICOM).

In the ICOM 4AT, the 47-pF capacitor was soldered to pin 5 of the i-f detector IC. In the Regency and the Standard, the capacitor was soldered to a similar point, i.e., the input of the 455-kHz ceramic filter.

Operation is quite simple. The three connectors, Ant., Spkr., and i-f, are plugged into the radio and the radio is set inside the paint can and secured by a rubber band or some such means to keep it from rattling around. Any suitable directional antenna is connected to the BNC jack on top, the 0–50-dB attenuator is set at 0, the sensitivity switch is set at "Max," and the hunt begins.

I have found during the several hunts I have used this system that after nearly a full-scale reading, the sensitivity switch can be set to "Min" for the rest of the hunt. Likewise, after the second near full-scale reading on "Min," the 50-dB attenuator can be switched in for the remainder of the hunt.

Between the rf shielding and the simplicity of operation, the system's effectiveness approaches that of pseudo-Doppler systems. Especially for stomping through fields. I have found I can get within 7 or 8 feet of a 1-Watt transmitter and the needle barely pegs at full attenuation.

For the experienced tinkerer or kit builder it is a two- or three-evening project. For the inexperienced or perfectionist, perhaps six or eight evenings. ■

Parts List

1	220-pF ceramic capacitor (optional)
1	10-pF ceramic capacitor
1	.04-uF ceramic capacitor
2	.01-uF ceramic capacitors
2	.1-uF tantalum capacitors, 10 V dc or more
1	22-uF tantalum capacitor, 12 V dc
2	1N914s
1	1k resistor, 1/4 Watt
1	2.2k resistor, 1/4 Watt
1	47k resistor, 1/4 Watt
1	6.8k resistor, 1/4 Watt
1	CA3089E (RCA or National)
1	2N2222 Transistor or equivalent
2	455-kHz i-f Transformers (yellow and/or white core from an old transistor radio)
1	Gallon paint can
1	50-mA meter movement
1	.001 feedthrough
2	47-Ohm resistors, 1/4 Watt
1	100-Ohm resistor, 1/4 Watt
1	330-Ohm resistor, 1/4 Watt
1	15k resistor, 1/4 Watt
1	Switch (3PDT)
2	Switches, push on/push off (SPDT)
1	12-V regulator and 2 9-V batteries, or
1	12-V Nickel-cadmium pack or gel cell

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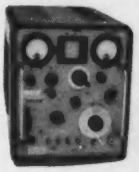

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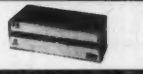

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What You See Is Where You're At: Part II

WA8YKN's universal digital frequency display stays on the mark no matter what your rig's mixing scheme.

I was pleased with the response to my article, "What You See Is Where You're At" (*73*, July 1985). There are now quite a few older general-coverage receivers sporting new digital frequency displays, and many of you took the time to write to me.

Most of these letters ended with something like, "I wish it was this easy to add a display to my (Kenwood, Yaesu, Heath, etc.)." After reading this recurring theme for the umpty-umpth time, I decided to design a Mark II version of the simple frequency display that, while retaining the simple programmable i-f offset feature, would be versatile enough to be used with *any* modern transceiver. The resulting display would be totally universal, yet simple enough to be attractive to the average home-brewer. "Universal" is a pretty strong word. It suggests the inclusion of the universe. I fully expect to hear from a reader on the fourth planet of Aldeveron with a Modulated Neutrino-Beam Transceiver. (No doubt the display would indicate quantum field intensity.) Let me say now that I do not have access to every rig ever designed, so there may be one somewhere that this frequency display won't cover. However, I can think of no mixing scheme to which this display cannot be adapted.

If you haven't read the article in the July issue, this is a good time to do so. This display is similar in construction and theory of operation, both of which were explained in detail in that article. That display was based on the 74196 programmable counter. The 74196 was selected for its speed, which is of top concern when tracking the low-powered vfo of a shortwave receiver over a 30-MHz range. Also, it is programmable, allowing a preset equal to the i-f frequency.

The 74196, however, will count only in the *up* direction, and as stated in the article, can be used only on receivers in which the vfo tunes in the same direction as the desired frequency. Virtually all single-conversion shortwave receivers, and even some amateur transceivers (such as the Argonaut) use this

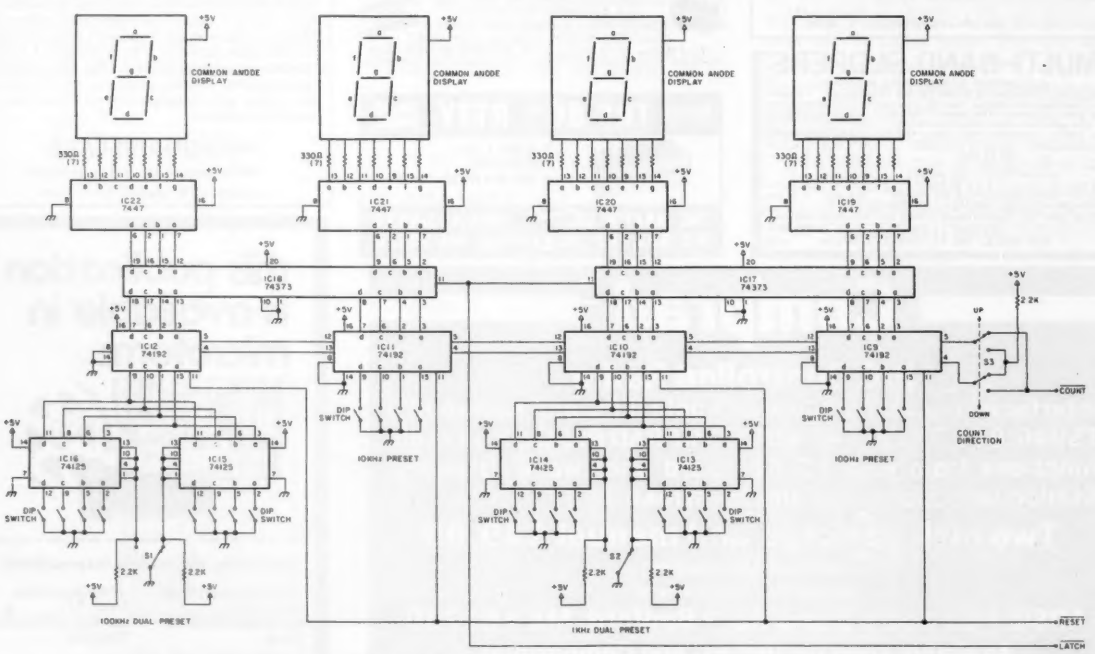


Fig. 1. Schematic of the "Frequency Display II."

scheme, and for these rigs the display works perfectly.

Many other transceivers use a multiple-conversion design in which the incoming signal is premixed using a crystal-controlled oscillator and mixer. The vfo always tunes over the same frequency range regardless of the band being used. And to complicate matters, the vfo usually tunes backwards. In fact, on some rigs the vfo will tune backwards on some bands and forward on others.

The vfo always starts with the same frequency, also, but our amateur bands do not. Some of them begin on X.000 MHz and some begin on X.500 MHz. Two offsets will therefore be required, just as most analog dials have two sets of markings. While we're at it, we should have a way to shift this offset by 3 kHz to allow for USB and LSB operation.

The design presented here overcomes all these problems. The 74192 counter is used, allowing both up and down counting. While not quite as fast as the 74196, it is adequate for our needs. The multiple preset for the 100-kHz and 1-kHz digits was accomplished through the use of 74125 tristate buffers, which select one of two sets of DIP switches for those digits.

For simplicity, only the digits to the right of the decimal point are displayed. There is no need to display the MHz digits, as we should be able to remember what *band* we're on!

At this point a problem surfaced. I don't own any equipment that uses this mixing scheme! I discussed this with John Farmer WA8GYP, who had been the first to evaluate the previous display. With only moderate arm twisting, John offered his Yaesu FT-101EE as a guinea pig.

This settled, I built the display in a few days, and the following weekend journeyed to far-off, exotic New London, Ohio, to try it out. The FT-101 series has the vfo frequency and 13.5 V dc available on the accessory jack, so no modification to the rig was required. Everything worked as planned, and John now has the only digital FT-101EE in New London. (The natives are suitably impressed.)

Circuit Details

Fig. 1 shows the count and display logic. The count input to the first 74192 is via S3, which selects either up- or down-counting modes. The Carry and Borrow outputs are connected to the up and down inputs of the next stage, and so on.

Resetting the counters by pulling pin 11 low loads the number present at the preset inputs, pins 15, 1, 10, and 9 (binary a, b, c, and d respectively). On the digits requiring only one preset, the number is set directly with DIP switches. Those digits requiring two presets use two sets of DIP switches, each isolated via a 74125 tristate buffer. Switching the enable lines low selects that preset. The other set of DIP switches (its buffer in the high-Z state) is ignored.

The latch and decoder logic operates exactly as in the earlier display. The 74373s happened to be on hand, and each one functions in this circuit just like *two* 7475 latches. This saves space and lowers the overall parts count.

Photo A. Why is this man smiling? See text!

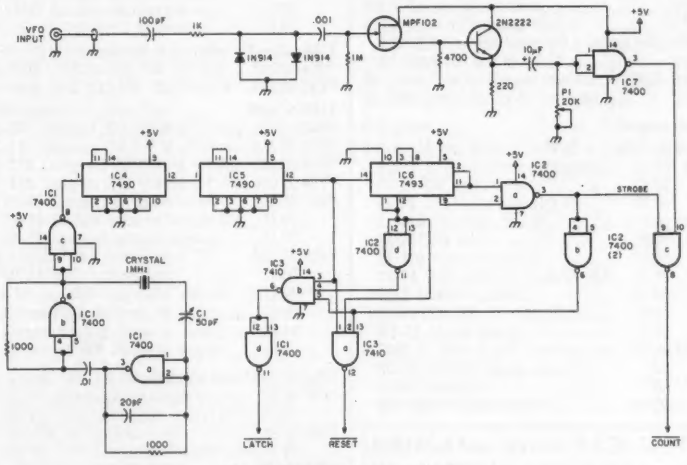


Fig. 2. Input and control logic.

Fig. 2 shows the timebase and control logic as well as the vfo-input circuit. The Count, Latch, and Reset signals connect to the appropriate inputs of Fig. 1. If you look closely at Photo B, you will notice a 5-MHz crystal and an extra 7490. At the time, I didn't have a 1-MHz crystal, so I used the 5-MHz one with a divide-by-five stage to produce the signal.

This worked for testing the operation of the display, but the old FT-243 crystal drifted quite a bit, so ultimately it was replaced with a quality 1-MHz crystal (soldered in place) and the extra divide-by-five circuit was disconnected.

Most modern transceivers have 12 volts available to power accessories, so the circuit of Fig. 3 uses an LM317 to reduce this voltage to the regulated 5 volts required by the display ICs. The 1000-Ohm pot (P2) is adjusted for 5.00 volts *before* the output is connected to the rest of the display. TTL ICs do not like overvoltage.

I recommend the use of LS (low-power Schottky) ICs over the standard TTL versions. Although functionally identical, the LS versions are slightly faster and draw only a fourth the current consumed by standard TTL ICs. This adds up to less drain on the power supply and considerably less heat buildup inside the cabinet, which is a big plus for stability.

When I built this display, the only 74192s I

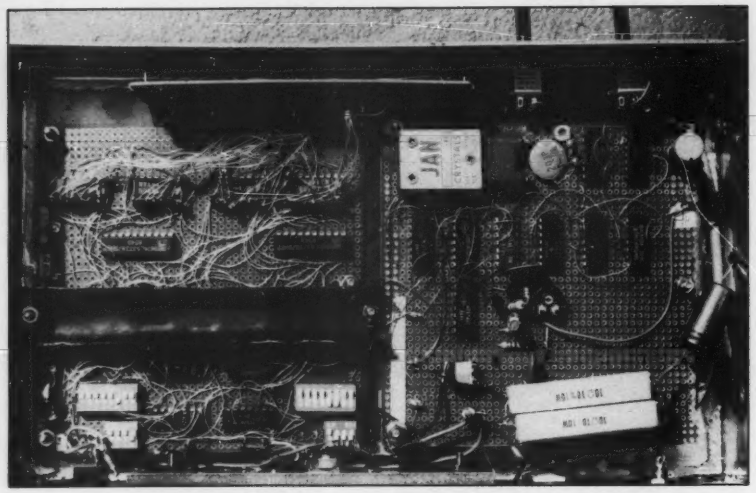


Photo B. Inside the frequency display. Plenty of room for everything. The heat sink for the regulator is mounted on the rear panel.

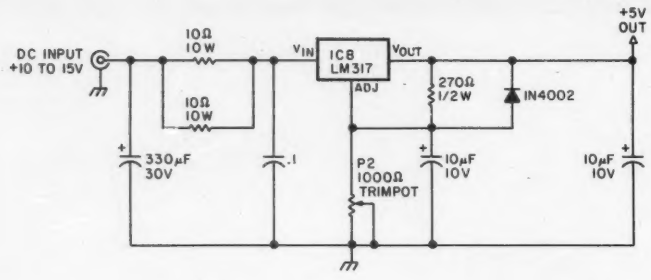


Fig. 3.

had on hand were some old high-power versions, and though they worked fine, they ran very warm. In fact, I ended up bending a strip of thin sheet aluminum to form a U-shaped heat sink, which I bolted down across the entire row of counters. A dab of white silicone grease on each IC carried the heat away, but the use of 74LS192 counters would eliminate the need for such measures.

No pinout is given for the common-anode displays since that varies with size and manufacture. If you purchase the seven-segment displays new, they will have pinout information with them. If you use surplus "bargain-pack" assortments (like I do), it is a simple matter to determine which pin goes where.

The anode usually is connected to several pins, easily found with an ohmmeter. A few minutes with a dc source, a current-limiting resistor, and two clip leads will identify the rest. A $1.98 bargain pack produced three large (.7″) displays in which all segments worked, and a smaller (.3″) one which I used as the 100-Hz digit.

Construction

I built the frequency display on two five-inch square pieces of perforated Bakelite™, one piece for the timebase and the other for the count and display logic. Connections were made point to point, using Radio Shack wire-wrap wire. Layout is not particularly critical (see Photo B for details).

The enclosure was made up from copper-clad circuit-board material soldered at the seams. I bolted a ¼″ thick strip of aluminum to the rear of the enclosure to act as a heat sink for the LM317 voltage regulator, and the opening for the display was cut with a Radio Shack nibbler.

The displays were mounted on a small scrap of perfboard mounted directly behind the opening. I used red-tinted plastic as a light filter. The blank leader from developed 35-mm color negatives also works well here.

The location of the three switches will depend on the mixing scheme of your transceiver. In the case of the FT-101, the vfo always runs in the backwards direction, so the up-down switch, S3, was mounted on the rear. (It could be eliminated if you have only one application in mind.)

S1 and S2, which select the display offsets, were mounted on the front panel to the left of the readout. A piece of ⅛-inch-sheet aluminum and two scrap angle braces bolted together form the lid. Be sure to drill plenty of ventilation holes over the regulator and the 10-Ohm resistors to let the heat escape.

After painting, the switches can be identified with Radio Shack rub-on lettering. The completed display measures 11″ wide by 2″ high and 6″ deep and is quite attractive with the FT-101 (see Photo C).

Setup and Operation

The timebase oscillator must be adjusted carefully to 1 MHz if the display is to be accurate. Either a good frequency counter or a receiver set to WWV can be used, adjusting C1, the 50-pF trimmer capacitor, for zero beat. An oscilloscope triggered on the Strobe signal (IC 2, pin 3) should display the timing waveforms shown in Fig. 4.

With the display operating but not connected to the transceiver, the DIP switches can be checked out for proper operation. With all the switches closed, all digits will read zero. Opening one of the four switches for a particular digit will cause the value of that switch to be displayed. For example, opening switch a on the 100-Hz digit will cause that digit to display 1; switches b, c, and d will similarly display 2, 4, and 8.

Opening more than one switch adds the values. To display 3, for example, open switches a and b. Opening all four switches will cause that digit to go blank. This isn't a fault with the display, it's just that all four switches add up to fifteen, and that's why the 7447 decodes binary 1111.

The digits with two presets are checked out in the same way, but each set of switches can be displayed only when selected by S1 or S2.

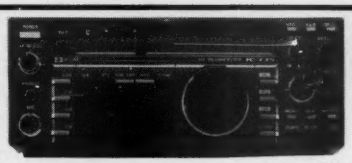
If everything checks out, it's time to hook the vfo signal to the input. Most transceivers have a vfo input available at the rear panel, so take a look at your manual. If it's necessary to provide your own tap, find the output of the vfo buffer and you'll see a capacitor coupling the vfo signal to the mixer. That's the point you want. Tap in with a 100-pF capacitor and bring the signal to the rear panel using small coax.

The input-gate bias is set by slowly adjusting the 20k trimpot, P1. Somewhere around the middle of its range, the display will start counting the vfo. In fact, with all the DIP switches closed and S3 in the up-count position, we now have a four-digit frequency counter reading out the last four digits of the vfo frequency.

On John's FT-101, the vfo tunes from 9.200 MHz at the low end of each band to 8.700 MHz at the high end. The display reads .2000 to .7000, counting backwards. By switching S3 to the down-count position, the display will read .8000 to .3000, and will now be counting in the proper direction.

Setting the DIP-switch presets is simple. Start with 80 meters. Set S1 to the X.500 position and set the transceiver to 3.500 MHz. With the FT-101, the display will read .8000. Adding 7 to the 100-kHz digit will cause it to read (1).5000—just what we want—so open DIP switches a, b, and c. The display will now agree with the dial.

Next, try 40 meters, setting S1 to the X.000 position. This selects the other set of DIP switches for the 100-kHz digit. Tune the dial to 7.000 MHz and, on the FT-101, the display will again read .8000. This time we need



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to add 2 to the left-most digit to cause it to read (1).0000, so DIP switch b is opened.

The USB-LSB switch, S2, is handled in the same manner. Set the transceiver on upper sideband and zero-beat a signal. Set switch S2 in the USB position and note the frequency displayed. Now switch the transceiver to lower sideband and again zero-beat the same signal. Set S2 in the LSB position and note that the display is reading low by 3 kHz. Adding .0030 to the count will fix it, so open switches a and b on the DIP switches currently active for the 1-kHz digit.

With the display now properly set up, using it is simple. 160 meters, 80 meters, and two segments of 10 meters require S1 to be set in the X.500 position; 40, 20, 15 and the rest of 10 meters require S1 to be in the X.000 position. Also, switch S2 must be set to agree with the mode of operation.

Adapting to Other Transceivers

Although the FT-101 was used in the previous example, any transceiver with a backwards-tuning vfo will require exactly the same procedure to determine the presets required and program the display. Any transceiver in which the vfo tunes forward on some bands and backward on others still will require two presets on the 100-kHz digit, since the displayed count will change when switching from up- to down-counting modes, but it should be possible to use a DPDT combining S1 and S3 into a single control. In this manner, the operation of the display with such a transceiver would be identical to that with the FT-101.

If your vfo always tunes in the forward direction, you probably would be happier building the 74196 version I presented in the July issue. This one will do it, but the extra complexity is unnecessary.

Accuracy

There is only one oscillator in a single conversion superhet, the vfo. It is always removed from the received frequency by exactly the i-f frequency—no more and no less. But in a modern transceiver using a premix oscillator and a bfo in addition to the vfo, there exists the potential for error.

Commercial frequency displays get around this by counting *all* the oscillators and displaying the sum. This type of circuit, however, is pretty complex for a home-brew project. By counting the one that tunes and presetting the counters to make up for the rest, a much simpler display results, one that is not only practical and low-cost but easy to understand and build.

How much of a trade-off is this? Let's consider. We've got the bfo covered with two presets available for USB and LSB, so even if these oscillators are slightly off, we can compensate with the DIP switches. We're *counting* the vfo, so there's *no* chance of error there. So the only possible source of inaccuracy is the premix oscillator.

If we set our DIP switches for one band, there's a chance that the crystal for another band may be a little high or low, causing the display to be in error. However, if we assume

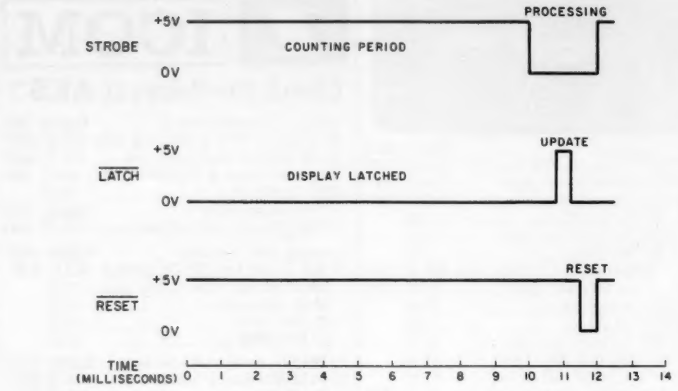

Fig. 4. Control timing.

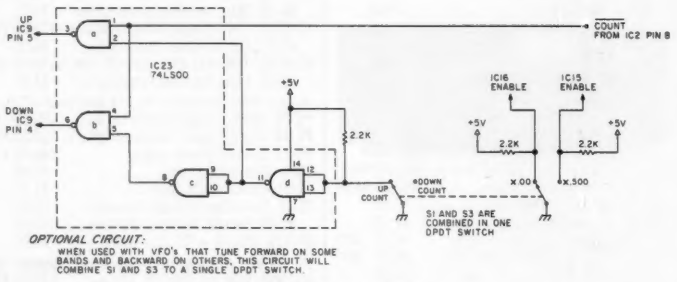

Fig. 5. Optional circuit.

that the manufacturer of the transceiver used reasonable care in designing and building his product, the error should be small. On John's FT-101EE, all bands were accurate to within 100 Hz except the 160-meter band and the 29.500 segment of 10 meters. Both of these were 200 Hz off.

Although this does represent a small error, this does *not* mean that the tuning is in any way ambiguous. The error does not change, and if John must know his *exact* frequency, he has only to subtract 200 Hz on these two bands. The resolution is there, and it is still possible to return within 100 Hz to any frequency.

Also to be considered is cost. A commercial display using the oscillator-summing method will set you back $200–$250. By settling for a small potential for error, we save a couple hundred bucks! Did WA8GYP

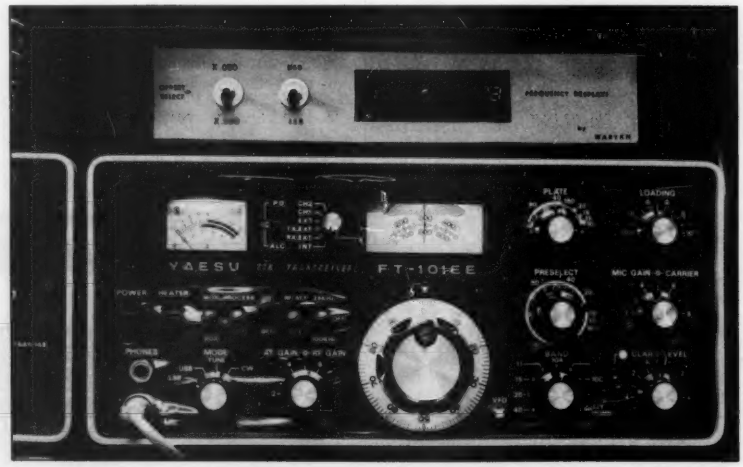

Photo C. Shown here with the Yaesu FT-101EE, this version of the simple frequency display can be used on any analog transceiver.

consider it a fair trade? Look at Photo A, and note the big smile on John's face! This display will cost around $40 purchasing all parts new. If you have a typical home-brewer's junk box, it can be done for much less.

Final Thoughts

The potential is here to add a simple, low-cost frequency display to just about anything. A little time with the manual of a particular piece of gear should give you a clear idea what will be required, and you can modify my basic layout to suit your individual needs. The display can also be tailored to your operating habits.

For example, I usually operate RTTY and CW. My only phone activity is an occasional contact on 75 meters. Since I never use USB, that preset could be used to make up for the 2125-Hz error on RTTY caused by feeding audio tones into the transmitter (AFSK). The display would then show my actual mark frequency! Get the idea? There's a lot of room for originality here.

Home-brew projects are fun and educational. It's an amateur tradition. And when your buddy sees those beautiful red-glowing digits you can say, "Yeah, I built that last week." That, my friends, is a feeling I cannot put into words.

I would enjoy hearing from anyone interested in this project, and will try to help with any specific questions. Please include an SASE, however. ■

Parts List

Integrated Circuits

1, 2, 7	7400
3	7410
4, 5	7490
6	7493
8	LM317
9, 10, 11, 12	74192
13, 14, 15, 16	74125
17, 18	74373
19, 20, 21, 22	7447

Displays
7-segment LED, common anode, 4 required

Capacitors
Ceramic discs, one each: 20 pF, 100 pF, .001 uF, .01 uF; electrolytic: (3) 10 uF, 10 volt, (1) 330 uF, 30 volt

Resistors
(28) 330 Ohm, (5) 2.2k Ohm, (3) 1k Ohm, (1) 4700 Ohm, (1) 1 megohm, (1) 220 Ohm, (2) 10 Ohm, 10 Watt, (1) 270 Ohm, 1/2 Watt; trimpots: (P1) 20k Ohm, (P2) 1k Ohm

Transistors
(1) 2N222, (1) MPF102

Diodes
(2) 1N914, (1) 1N4002

Switches
(S1, S2) SPDT miniature toggle switches, (S3) DPDT miniature toggle switch, (6) 4-pole DIP switches

Misc.
(1) 1-MHz crystal, (1) RCA jack, (1) #SO-239 coax jack, perfboard, wire, solder, cabinet materials, etc.

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1470		RG223/U Mil Spec. - Silver	80.00	.85
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8C1620		2-16 Ga., 6-20 Ga. Heavy Duty	34.00	.36
		HARDLINE — 1/2"		
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PL259AM		Amphenol PL259		.89
PL259TS		PL259 Teflon/Silver		1.59
UG21D		Type N for RG8, 213, 214		3.00
UG175		Adapter for RG58		.22

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Total Solar

Plug your shack into the sun! Here are complete plans for energy independence.

Photovoltaic electricity is rapidly becoming the technology of choice for powering amateur radio stations. With the price of photovoltaic panels falling, large arrays are now within the range most hams can afford.

To make the most efficient use of the available energy, a photovoltaic controller will be needed. If the solar array were to be left connected to the batteries all the time, severe overcharging would occur, resulting in excessive electrolyte gassing and unnecessary loss of electrolyte. Physical damage also can result in the form of warped plates and the dislocation of the plate's lead paste. Likewise, in times of low periods of sunlight, the batteries could become damaged by deep-discharging.

The controller described below will allow the direct charging of lead-acid batteries without the need of a blocking diode (in the direct-charge mode). It also will provide a low-state-of-charge warning system. When the batteries become fully charged, a second, floating charge system will keep them topped up and ready to go. Energy-load management can also be installed.

Charging Techniques

The techniques by which batteries are charged via photovoltaics have been and still are varied. However, two basic technologies are used: shunt mode and direct (switching) mode.

In the shunt mode, array power is diverted from the batteries by shunting power to ground on the array side of a blocking diode. The battery-terminal voltage is monitored, and by a feedback loop to the controller, excess power is diverted. This excess energy is dissipated as heat, usually by resistors.

With the direct mode, a relay or transistor switch is in series between the array and the batteries. As charging progresses, the battery-terminal voltage will rise. It is then possible to approximate battery state-of-charge to this terminal voltage. By monitoring the battery-terminal voltage, the controller can decide when to stop current flow and may do so by opening the relay or turning off the switching transistor.

While the shunt-mode controller can operate with no moving parts, the heat built up by the resistors has to be removed. This calls for a large bulky unit. Likewise, if the switching controller uses a relay, we now have one moving part that may go bad in time. The use of a transistor switch will get by that problem. However, the transistor must now be able to pass the total current of the array. Careful heat-sinking will be required. There is also the voltage drop across the transistor junction that will reduce efficiency.

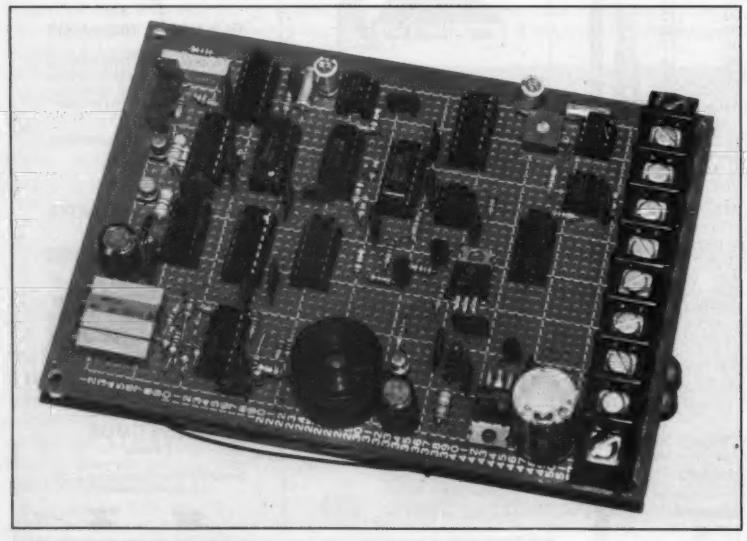

Photo A. The complete control logic. Some minor changes were made to the circuit after the photograph was taken.

A Better Controller

Look at Fig. 1. The basic circuit for the controller makes use of the LM339 voltage comparator. This chip provides an output that is at a high state when the inverting input is below the reference voltage. When the voltage on the inverting input is equal to or greater than the reference voltage, the output switches to a logic low.

The reference voltage comes from the power-supply circuit. A 78L05 provides a constant 5 volts for the comparators while a 7805 regulator was wired to provide 10 volts for the remaining logic. The usual bypassing was done so the circuit logic can be used around rf fields.

To set up a "voltage window," comparators A and B connect first to a 4050 noninverting hex buffer. From there, the output of the buffers connect to a NAND gate of a

4011. The other two gates make up an R/S latch. When the battery voltage drops below the "reset" window, a logic 0 is applied to set the latch. The output of the R/S latch will go to logic 1 and into the 4082.

The output will stay this way until the battery voltage rises above the float-charge level. At that time comparator A will go low, resetting the latch and turning off the output. An inverting buffer, a 4049, will then turn on transistor Q1 and light the float-charge LED.

Comparator C is wired as the first two, but instead of monitoring the battery voltage, its job is to look at the array voltage. If the array voltage is above 10.5 volts, the output will remain a logic 0. A second gate of the inverting buffer provides the proper logic sense for the 4082.

The comparator will not be able to do its job, however, because the relay will be closed. This will fool the comparator into believing the battery voltage is the same as the array voltage. To get around this, some means of opening the relay contacts is needed so the comparator can "see" the array voltage. The relay must then close to continue charging. This is where the 4082 and the clock circuit come into play.

The clock that I had planned originally used a color-burst crystal and an MM5369 17-stage divider. However, to slow the clock

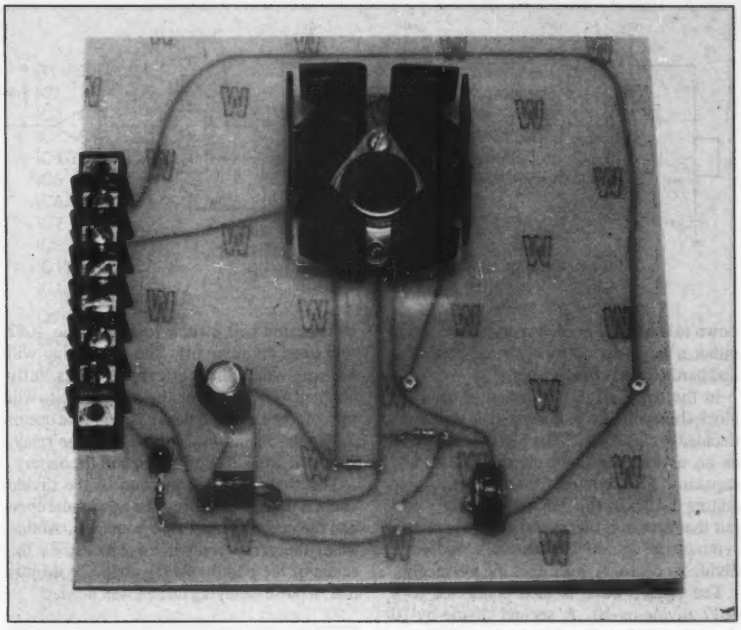

Photo B. The float regulator board. Since the circuit is simple, a PC board was made using rub-on resist. Note heat sink on the LM317K.

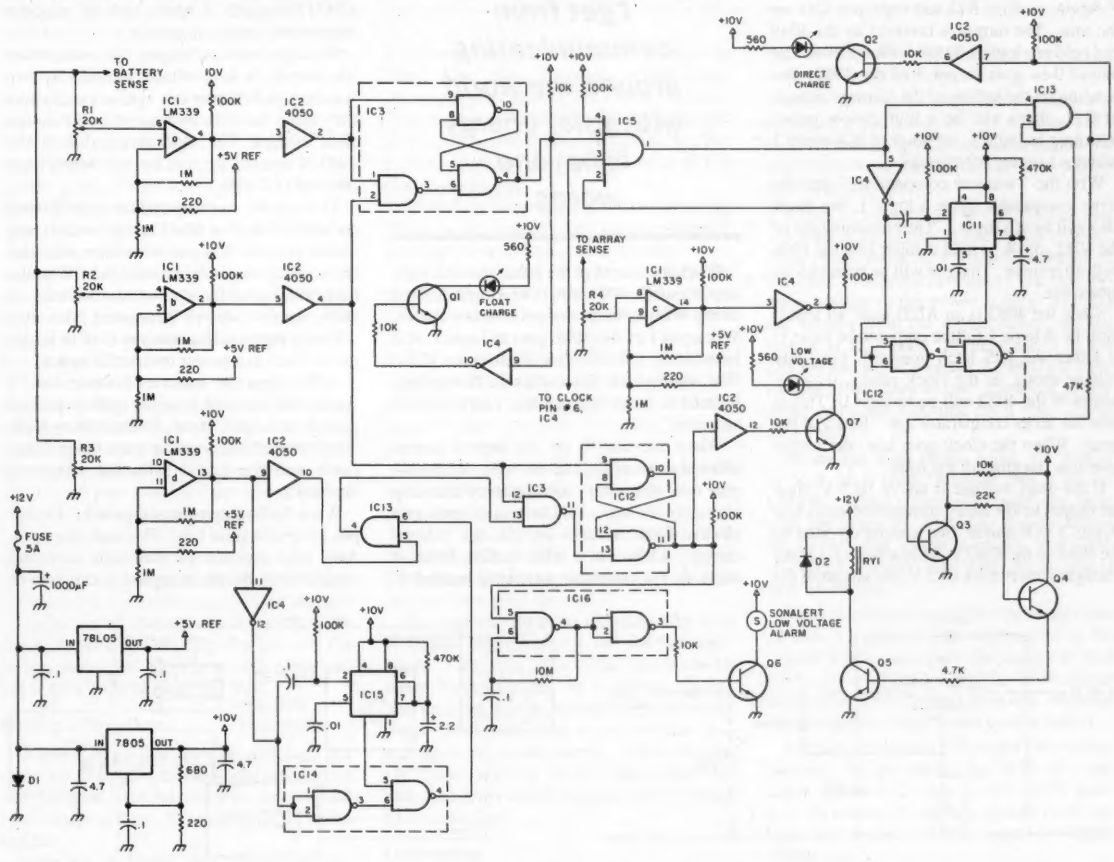

Fig. 1. Schematic diagram.

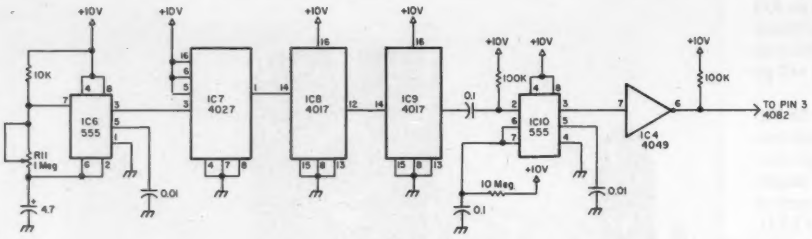

Fig. 2. Clock circuit.

down to the time I needed required the use of either a large divide-by chain or expensive and hard-to-find components.

In the early stages of design, I used the clock shown in Fig. 2. It worked so well that I decided to stay with it. The 555 timer is wired as an astable oscillator. Resistor R11 and capacitor C10 control the frequency. By adding a clocked flip-flop to the timer's output that acts as a binary divider, a perfectly symmetrical square wave is available for the divide-by chain. A 4027 does the job nicely.

The square wave is then connected to a 4017 divide-by-10. A second divide-by-10 slows the clock pulses down to a usable period. The output of the last 4017 is connected to a second 555 timer, wired as a one-shot.

Again, resistor R12 and capacitor C11 set the time. The output is inverted by the 4049 and held to a logic 1 by the 100k resistor. The output then goes to pin 3 of the 4082. Depending on the setting of the trimmer control of R11, there will be a high-to-low pulse, returning to logic 1, on pin 6 of IC4 every 2 minutes to every 90 minutes.

With the "window comparators" and the array comparator all at a logic 1, the clock also will be at a logic 1. The remaining pin of the 4082, pin 4, is held at logic 1 by the 100k pull-up resistor. That pin will be reserved for future use.

Since the 4082 is an AND gate, all inputs must be at logic 1 for the output to be logic 1. If either the R/S latch goes off, the array voltage drops, or the clock pulses, then the output of the 4082 will go to logic 0. This is how the array comparator can "look" at the array. When the clock goes low, the output goes low, turning off the relay.

If the array voltage is above 10.5 V, then the output of the array comparator stays low (logic 0). (Of course, that is being inverted by the 4049 so the 4082 will see a logic 1.) If the voltage is lower than 10.5 V, the output of the comparator will switch logic and the 4082 will keep the relay off. The same thing will happen when the battery becomes fully charged. The float voltage of 14.5 volts will turn off the latch and the 4082 will lose one of its inputs. It, in turn, will shut off the relay. This will prevent overcharging of the battery.

The clock pulse at the end of the divide chain is just that, a pulse. The relay must open and the contacts must stop bouncing. At that time, the array comparator can decide the status of the photovoltaic panels. To do just that, a pulse-delaying circuit was needed.

". . . the thrill I get from communicating around the world with solar energy is beyond words."

When the output of the 4082 goes to a logic 1, pin 1 of the 4081 is held to a logic 1. Pin 2 of the 4081 goes to the pulse-delay circuit. When pin 1 of the 4082 goes to logic 1, it is inverted by a 4049. This starts timer IC11. The output of this timer stops the flow of logic until it times out—in this case, about 3 seconds.

When that time is up, the logic 1 is now allowed to go to pin 2 of the 4081. With both pins now at logic 1, the output of that chip also goes to logic 1. The output goes two places. First, it turns on Q2, the "direct charge" LED, via a 4050 buffer. Next, it turns on the transistor switching needed to operate the relay. The TIP 29 transistor will handle about 1 Ampere of coil current.

If the battery voltage rises to the float setting of 14.5 volts, the relay will open. When it does, the float-regulator circuit will take over and maintain the battery in a float condition. The float current will depend upon the condition of the batteries and the amount of photovoltaic energy. The float-regulator circuit is connected across the relay contacts of the main relay. When the clock times out and the relay opens for the array check, there is little or no contact burning.

Fig. 3 shows the float-regulator circuit. As can be seen, an LM317 is used in a conventional power-supply configuration. I had to place a diode in series with the output of the regulator chip because the regulator sometimes would not start up—perhaps because of the battery voltage on the output of the regulator.

With this diode in place, there is no trouble with the regulator operating as it should. Trimmer pot R1 sets the voltage of the regulator. It can be used to adjust the current flow of the regulator when in the float-charge mode. Its adjustment is not critical. The LM317 requires a heavy sink to pass the maximum 2 Amps of current.

To keep from discharging the battery bank too deeply, a low-voltage warning system was installed. It operates almost exactly like the circuit used to monitor the full-charge float system. The last comparator of the LM339 is used to monitor the low-voltage point of 11.7 volts.

To keep the warning system from turning on and off with a load, the pulse-delaying circuit is used. If it was not connected, then the warning tone would follow the CW as the transmitter would load down the batteries. A rather exotic sidetone generator! This also allows a high-current turn-on load to be ignored (such as a power inverter or motor).

Also, when the batteries become low, I wanted the warning to sound until they were almost recharged. If not, a dead battery bank would shut off the warning when the next day came and the panels starting charging the bank.

When the battery voltage dips to 11.7 volts, pin 12 of IC4 goes low. This trips the time-delay of 2 seconds. At that same time, the comparator's output is applied to one side of

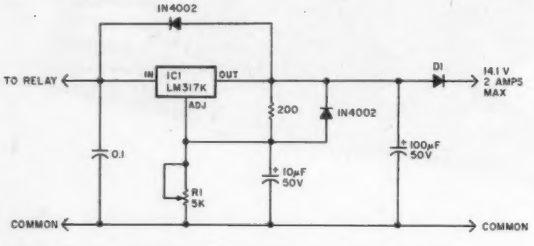

Fig. 3. Float-regulator circuit.

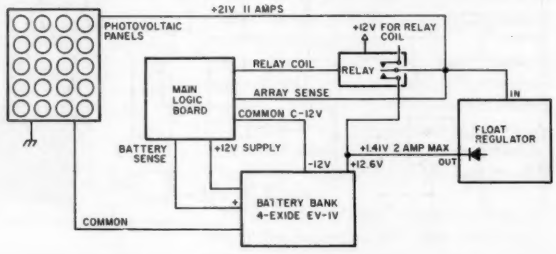

Fig. 4. System diagram.

an AND gate, IC13. When the 555 timer times out, the other half of the AND gate gets a high logic. With the reset comparator (B) high, the R/S latch is set. This turns on the gated oscillator which drives a piezo-electric sounder. The latch also drives Q7 on via the buffer gate and turns on the low-voltage LED.

When the voltage reaches the reset point of 12.5 volts, the R/S latch is turned off. It should be noted that the reset voltage and the reset window voltage will be the same. I didn't want to use another comparator.

With the proper transistor switching, a relay could be placed in use as a low-voltage disconnect. A remote solar-powered repeater could be wired to disconnect the power amplifier when the battery bank is low. Then reconnect the amplifier when the batteries become 60% charged.

Parts List—Main Logic

R1, R2, R3, R4	20k Ten-turn trimmers
IC1	LM339 Quad comparator
IC2	4050 Hex buffer
IC3, IC12, IC14	4011 Quad NAND gate
IC4	4049 Inverting buffer
IC5	4082 4-Input AND gate
IC6, IC10, IC15, IC11	555 Timers
IC7	4027 Flip-flop
IC8, IC9	4017 Decade counters
IC13	4081 Quad AND gate
IC16	4093 Schmitt trigger
Q1, Q2, Q3, Q6, Q7	2N2222A
Q4	2N2907
Q5	TIP 29
78L05	
7805	
C1	1000 uF @ 25 volts
D1	1N4003
D2	1N4002
RLY	12-Volt coil, 10-Amp contacts, DPDT
R11	PC mount, 1-meg trimmer
SY1	Piezo-electronic sounder
Regulator Board	
IC1	LM317K Regulator
R1	5k PC-Mount pot
D1	3-Amp Diode (use RS/276-1144 for 3 Amp)
	Heat sink for regulator

Operation

In normal use, the controller logic will work as follows. Assume full array power and a 90% charged battery bank. At sunrise, the array voltage will rise above 10.5 volts. Since the battery voltage is below the reset point of 12.5 volts, the relay is turned on and full array current is allowed to flow into the batteries.

Every hour the clock will time out and cause the relay to open up. The array comparator will look to make sure the array is still 10.5 volts. It is—and the relay will again close. As the batteries increase their charge, the terminal voltage will rise. When it comes up to the float-set voltage of 14.5 volts, the relay will drop out. The float regulator will now supply a maximum of 2 Amps to the battery bank. This current will fall back to about 500 mA to 1 Ampere.

If a load is applied to the batteries, the float regulator will try to supply the maximum current of 2 Amperes. If the load is great enough, the battery-terminal voltage will fall to the reset point of 12.5 volts and again the relay will be turned on and full array current will be applied.

Every hour the array voltage will be checked. When sunset arrives, the array voltage will begin to drop. When it goes below 10.5 volts, the array comparator will tell the logic to shut off the main relay. The system will then wait until the next morning, when the whole process repeats itself.

As can be seen, the relay will remain closed as long as the batteries need charging. This can be used as a cheap and dirty load-management system. By connecting the load through a second set of contacts on the relay, only when the batteries are fully charged will the load be connected. Of course, only nonessential loads should be done this way.

Putting It Together

Construction is best done on perfboard. As there are several options, no printed circuit was designed. One may not wish to install the low-voltage system. That choice is up to the builder.

Since the controller uses CMOS devices, some care should be used in their handling. Try to avoid static since this will damage the chips. Also, there are some unused gates. The input pins should not be left floating. They must go somewhere! Either tie the pins to Vcc or to ground. (Not shown on the schematics, .1-uF capacitors are placed at all Vcc pins of the chips.)

There is nothing about the controller logic that is carved in stone. Feel free to change or to delete parts of the logic not needed.

The circuit could be wired for different types of ICs. The 4011 chips that I used for an R/S latch can be replaced with a 4044 quad latch. Likewise, the 555 timers can be replaced with a 4528B. Of course, that is one reason no PC was done. In fact, all the 555 timers needed could be replaced with one quad 555 timer, the 558. The rest of the parts are very common.

There are only two components that should not be substituted: the main relay and the 10-turn trimmer that set up the comparator. The relay I use here is surplus and was picked up at a local flea market. The contact rating is 25 Amperes. The relay must be able to handle the total current of the array.

The best way to build the controller is in modules. Photo A shows the finished logic board. This way, parts of the circuit can be tested before moving on to the next stage. The modules can be placed in groups on the single perfboard. The main modules are: comparators, power supply, reference supply, pulse-delaying circuit, and output circuit. The low-voltage warning system would be installed last.

Calibration

To set up the controller, you will need a digital voltmeter, a VOM or logic probe, and a variable power supply.

While the low-voltage warning system will be adjusted last, it may or may not sound. To keep it from going off until needed, pull the 4093 from its socket. Replace it when setting the warning system.

Apply 12 volts to the circuit. Check that +5 volts at the output of the 78L05 is there. Also check for +10 volts at the output of the 7805. Temporarily connect the battery-sense voltage to the power supply. Reading the voltage from the digital meter, set the supply at 12.5 volts. Monitor pin 2 of the LM339 and adjust trimmer R2 until the logic switches from high to low. Rock the supply about and make sure that pin 2 goes low at 12.5 volts.

To set the float point, adjust the supply to read 14.5 volts. Monitor pin 1 of the LM339. Adjust trimmer R1 until the logic goes low (logic 0). Assuming that the rest of the circuit was wired correctly, the float-charge LED should light when the voltage is over 14.5 volts.

The next comparator will be the array comparator. Connect a wire temporarily to the "panel sense" and adjust the supply to read 10.5 volts. Monitor pin 2 of the 4049. Adjust trimmer R4 until the logic goes low. Increase the voltage and pin 2 should go to a logic 1.

The last comparator will be the low-voltage warning. Set the supply for 11.7 volts and adjust trimmer R3 until pin 12 of IC4 goes low. Increasing the voltage should make the logic switch low. At this point, the alarm should sound.

All the voltage set points should be adjusted

more than one time. You want the logic to switch at the required setting.

Remove all the jumpers and disconnect the power supply. The controller can now be placed in use. I used industrial conduit boxes to house the circuit boards. Since I use both solar and wind power to operate the station, both control systems are located together.

Troubleshooting

If something is not working, then help may be had at the test points. Make sure that the 555 oscillator is running in the clock. Look at pin 3. By following the pulse through the divide-by chain, any problems will be uncovered. Pin 1 of the 4082 must be logic 1 (high) for the relay to close. If it is and the relay is not closed, check for trouble in the pulse-delaying circuit or the output switching. If the wiring is fine, then start looking for bad chips. Use sockets.

Before the controller is put into use, some information about batteries may be helpful. There are two basic types of lead-acid batteries on the market, the lead-antimony and the lead-calcium. As the name implies, the lead-antimony battery contains lead alloyed with antimony while the calcium battery is composed of lead alloyed with calcium. Both batteries have voltage outputs of about 2 volts per cell.

The lead-antimony battery must now and then have its cells equalized. This is done by slightly overcharging the battery until all cells read the same specific gravity. The cells use up a greater amount of water than the calcium battery. In fact, most of the so-called "sealed automobile batteries" are lead-calcium. The lead-calcium battery is less likely to sulfate. However, the lead-antimony battery has a much better life cycle and, because you can check the cells for specific gravity, much data may be obtained on battery condition.

Caveat

There is a fact that should be noted. The amount of recharge current should be adjusted to the amount of storage. In other words, don't try to recharge 500-Ah batteries with only 1.5 Amps of solar energy. While it will in fact get the job done, the controller will not be needed. With array current under 35 Watts, no controller would be needed—just a diode to prevent discharging at night.

On the other hand, don't try to charge up a motorcycle battery with 14 Amps of current. The controller will be fooled by the charge rate and stop the direct-charge rate too soon. The bottom line is to size your battery capacity to match your charging current.

All of the voltages listed here were found to be correct for my station's batteries and solar array. The main thing to remember is that the batteries are not fully charged when they reach 13.8 volts. We have to put more back into them than we take out. That is why the float voltage is 14.5 volts.

At night, with a small load on, the "surface charge" will be removed and the true standing voltage will be at the terminals. This will be about 12.6 volts, depending on the temperature of the electrolyte. My solar array will put into the batteries (on a cool bright day) about 11 Amps. When the batteries just start to gas, the terminal voltage is 14 volts. When the voltage hits 14.5 and the controller switches over, the specific gravity reads 1.280.

Total Solar

Fig. 4 shows the hookup into the system. Note that the battery voltage-sense wire goes directly to the battery. Don't cheat and take it off the controller supply feed. The array sense must go to the array side of the relay contact. The float regulator connects across the relay as shown.

That will finish this project. If you use the controller as a building block, expanding the system will be much simpler. A master-slave control unit would be next. To make equalizing the battery bank easier, an SPDT switch may be placed in the battery-sense line. This would select the actual battery voltage or a predefined set voltage. That way, the battery will get an overcharge and equalize its cells. A limited overcharge will be good for the batteries every now and then.

No matter how many times I watch the ammeter move up and down, the thrill I get from communicating around the world with solar energy is still beyond words. Perhaps you, too, will give it a try, now that you know how to control the power of the sun! ■

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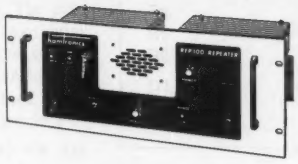
440	$780	$980



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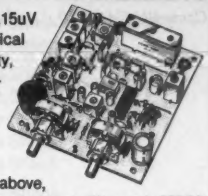

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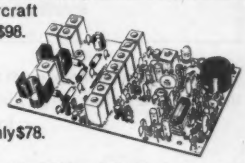

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Antenna Input Range	Receiver Output
28–32	144–148
50–52	28–30
50–54	144–148
144–146	28–30
145–147	28–30
144–144.4	27–27.4
146–148	28–30
144–148	50–54
220–222	28–30
220–224	144–148
222–226	144–148
220–224	50–54
222–224	28–30

UHF MODELS	
Kit with Case	$59
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Wired	$75

432–434	28–30
435–437	28–30
432–436	144–148
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	Exciter Input Range	Antenna Output
For VHF, Model XV2 Kit $79 Wired $149 (Specify band)	28-30	144-146
	28-29	145-146
	28-30	50-52
	27-27.4	144-144.4
	28-30	220-222*
	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-146	28-30
For UHF, Model XV4 Kit $99 Wired $169	28-30	432-434
	28-30	435-437
	50-54	432-436
	61.25	439.25
	144-148	432-436*

*Add $20 for 2M input

VHF & UHF LINEAR AMPLIFIERS. Use with above. Power levels from 10 to 45 Watts. Several models, kits from $78.

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MODEL	TUNES RANGE	PRICE
LNG-28	26-30 MHz	$49
LNG-50	46-56 MHz	$49
LNG-144	137-150 MHz	$49
LNG-160	150-172 MHz	$49
LNG-220	210-230 MHz	$49
LNG-432	400-470 MHz	$49
LNG-800	800-960 MHz	$49

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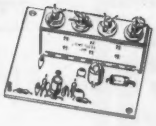
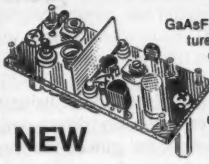


Model	Tuning Range	Price
HRA-144	143-150 MHz	$49
HRA-220	213-233 MHz	$49
HRA-432	420-450 MHz	$59
HRA-( )	150-174 MHz	$54
HRA-( )	450-470 MHz	$64

MINIATURE PREAMPS



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MODEL	TUNES RANGE	KIT	WIRED
LNW-144	120–150 MHz	$19	$34
LNW-160	150–200 MHz	$19	$34
LNW-220	200–270 MHz	$19	$34
LNW-432	400–500 MHz	$19	$34

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MODEL	TUNES RANGE	KIT	WIRED
LNS-144	120–150 MHz	$68	$98
LNS-160	150–180 MHz	$68	$98
LNS-220	200–240 MHz	$68	$98
LNS-432	400–500 MHz	$68	$98

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Agc, PDQ

Take the cotton out of your ears—add automatic gain control to your Century/21.

It's happened to all of us: You're using a no-frills receiver, probably direct conversion, and you've got the gain all the way up trying to copy that weak one down in the noise, and all of a sudden—screech! A local has come on and nearly melted the headphones before you can crank the gain back down.

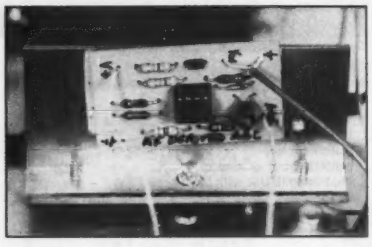

Photo A. PDQ agc circuit.

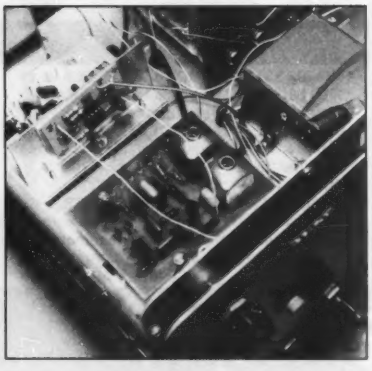

Photo B. PDQ circuit installed in a Century/21.

Well, before you throw your hands up in disgust and condemn the ol' rig to exile on the closet shelf, have a look here. All that radio needs is a little agc—and this simple circuit just may be the ticket!

Agc stands for automatic gain control, and it is just that: a feature in a receiver that automatically adjusts the gain of the receiver to keep the audio output at a fairly constant level over a wide range of signal strengths. In other words, for very weak signals the gain is adjusted higher, increasing the audio level; for strong signals, the gain is adjusted lower, decreasing the audio level.

Many of the less expensive receivers or transceivers on the market lack an agc feature, particularly the QRP radios. The Ten-Tec Century/21 is typical. I designed the "PDQ Circuit" for use in my Century/21, but with a little modification it can be used with other radios having similar configurations. It is easily built, requires very little modification to the receiver, and is simple to remove should you ever decide to restore your radio to its original condition.

Principle of Operation

There are several ways to achieve automatic gain control in a receiver. They all give the same general results, but some provide better performance than others. The strength of the signal is sampled after the filter stage

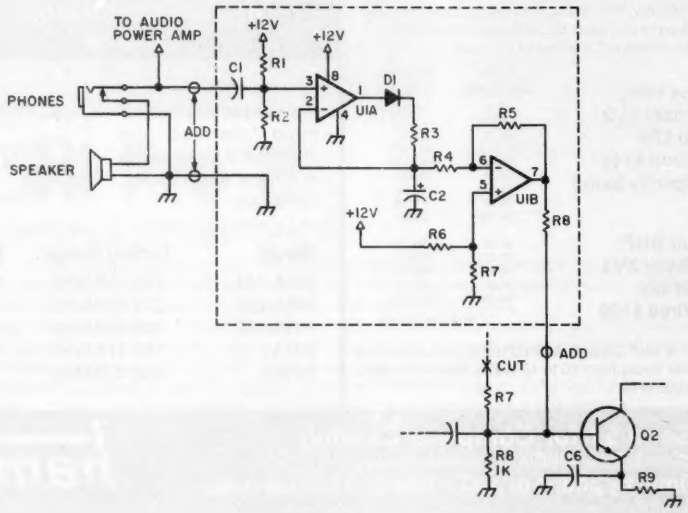

Fig. 1. Agc schematic.

which provides the selectivity for the receiver, and one or more of the gain stages in the receiver are adjusted to accommodate the level of signals being received at any particular instant.

Some methods sample the signal at the i-f stages, some in the audio section. The gain can be adjusted at the i-f. This particular circuit samples the signal at the audio stages, and adjusts the gain at the i-f stage. (Additional reading on the subject can be found in the references listed at the end of this article.)

The schematic in Fig. 1 shows the agc circuit added to the Century/21. Audio is taken from the headphone jack on the front panel and the peaks of the audio are detected by op amp U1A, and D1, R3, and C2. D1 rectifies the signal, and the positive peaks charge C2 through R3. The time constant of the "attack" of the agc is set by this RC network. The output of this peak detector is inverted and level-shifted by U1B so that the agc-control voltage at U1 pin 7 ranges from +6 V for no signal input to 0 V for large signals. The "decay" of the agc is determined by the RC network formed by R4 and C2.

R7 and R8 on the Century/21's front-end board set the operating bias for the i-f amplifier, Q2. This is normally fixed at +1.8 V in receive mode. Note: Before any /21 owners begin complaining, please note that the voltage chart in the owner's manual contains a typo: Q1's and Q2's values are all swapped!

By lowering the voltage on the base of Q2, its operating point can be pulled closer to cutoff, reducing its gain, until finally it will pass no signal at all. So by removing the normal voltage source by cutting at R7 as shown in Fig. 1 and adding the wire to the agc board, we have added agc to the Century/21's list of features.

The proper range of control voltage, +1.8 V to 0 V, is obtained by selecting the value of R8 on the agc board—in this case, 2.7k Ohms. This value, in conjunction with R8 on the front-end board (1 kilohm), forms a resistive divider, properly scaling the range of the control voltage.

Parts List

C1	.01 uF ceramic	Radio Shack, other sources
C2	10 uF tantalum	Radio Shack
R1, R2, R6, R7	47 kilohm, 1/4 Watt, 5%	Radio Shack
R3	1 kilohm, 1/4 Watt, 5%	Radio Shack
R4	100 kilohm,1/4 Watt, 5%	Radio Shack
R5	220 kilohm, 1/4 Watt, 5%	Radio Shack
R8	2.7 kilohm, 1/4 Watt, 5%	Radio Shack
D1	1N914, 1N4148, etc.	Radio Shack
U1	LF412, TL084, etc.	Radio Shack

Construction

Since the circuit operates at audio frequencies, construction and parts selection is relatively noncritical. The resistor pairs R1/R2 and R6/R7 are not critical in value, but should be selected to match closely. Op amp U1 could be just about any of the common FET input types. I selected the LF412 simply because I had one in the junk box, and it had two op amps in one package. Try adjusting the values of R3 and R4 if you're of the experimental bent; the attack and hang times will change.

I mounted the circuit on the heat sink on the adjacent low-level driver board, using some of that double-sticky foam tape available at hardware stores. I used a double layer to insure against shorting through the tape. Incidentally, if you ever need to move one of those through-the-glass mobile VHF antennas, this tape is a perfect replacement for the stuff that came with the antenna.

Fig. 2 shows the foil side of a printed-circuit layout I used. On small projects like this, I generally cover the copper of a small piece of board with wide masking tape, and use a sharp knife to remove the tape where I want the copper to be etched away. It takes a steady hand and more time than it's probably worth, but it's good therapy—and what's a hobby for if not to creatively "waste" time?

Fig. 3 shows the placement of the parts for the printed-circuit layout from the component side of the board.

Operation

Operation is simplicity itself: just turn on the receiver! It is possible that when the audio gain is set very high, a noticeable "pumping" of the audio will take place. This is characteristic of audio-derived agc and would require a far more complex "cut-and-jump" to the receiver to fix. I decided to keep this project simple, and not have to perform major surgery on my radio. The cure is simply to turn the gain down until the pumping ceases. The audio level will drop very little, if at all (the agc is doing its job!), and the pumping action will disappear.

A worthwhile wrinkle to add to this project would be to put a switch on the front panel that could be used to defeat the agc when desired. An SPDT switch at the X mark on the front-end board (Fig. 1) could select between the agc and the normal circuit. Better yet, how about a switch to change the hang time by switching in different values for R4? At any rate, have fun with this project and with your new old radio! ■

References

1. *The ARRL 1985 Handbook*, Chapter 12.
2. *Solid State Design for the Radio Amateur*, pp. 90–94, ARRL.

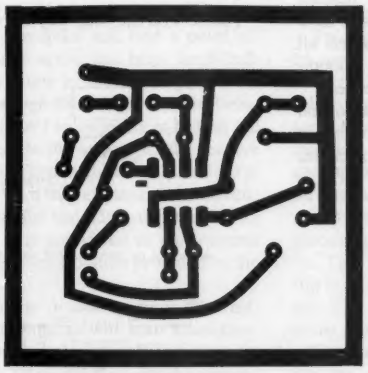

Fig. 2. PC board, foil side.

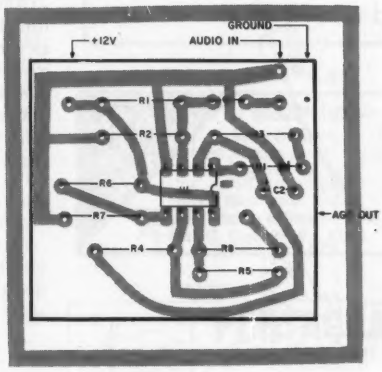

Fig. 3. PC board, component side.

Joe Roeder WBØWPY
2021 N.W. 65th #4
Seattle WA 93107

Radio to Go

If you can't bear to be parted from your rig, strap on WBØWPY's VOX headset.

The term "ham radio operator" usually conjures up the image of a man sitting in some remote corner of his basement surrounded by racks of glowing equipment, puffing on his pipe while talking to some far-off exotic land, the gentle buzz of 60 cycles oozing out of every box. Occasionally he flips a switch, jots something down, or relights his pipe.

On the Go

I'm 27 and active in cycling and backpacking, so I don't fit the stereotyped image of a "ham," and I'm sure that many of you don't, either. Unfortunately, that may mean all your radio equipment is in mothballs most of the time. I have a way to let your gear see the light of day.

Solid-state equipment is ideally suited for transportation—trouble is, we still have to *operate* it, sometimes under less than ideal circumstances. Ever try to work 20m sideband while driving somewhere in a manual-shift car? If you had a headset wired to the radio, your hands would then be free to do what is most important—keeping your vehicle on the road.

A Solution

Pick up one of those personal communicator radios—that uses 49 MHz FM for short-range contacts—at most two-way radio dealers and use the headset from it. The prices I've seen range from $50 down to $22 on sale. That's not bad, especially if you've been looking at Telex prices. Even the headset from ICOM costs $40, and that doesn't have an antenna. The communicator headsets all have one earpiece, an antenna, and a boom-mounted electret condenser microphone.

Remove the headset from the radio and either file the radio parts for future projects or chuck them. There are three coax cables coming from the headset. The lead that goes "click" when you check it with an ohmmeter is the earpiece. Check for connection between the antenna rod and the remaining two coax centers, and you'll find the antenna coax that way. The one remaining is the mike (Fig. 1). Wire a 3.5 mm stereo plug on the mike and speaker wires, and a 2.5 mm plug on the antenna wire. I'll talk more about the antenna later; the headset should be all set for now.

Now make an adapter cord for your rig. If the radio doesn't have voltage on its microphone line, you'll have to modify your radio to power the mike (Fig. 2). It will still be useful for your old mike as well. If you have an extra pin on the microphone jack, run a wire to the rig's speaker. (Some radios bring speaker-level receive audio to the mike jack already; check your schematic.)

Tape Recorder to the Rescue

You're well on your way to being able to

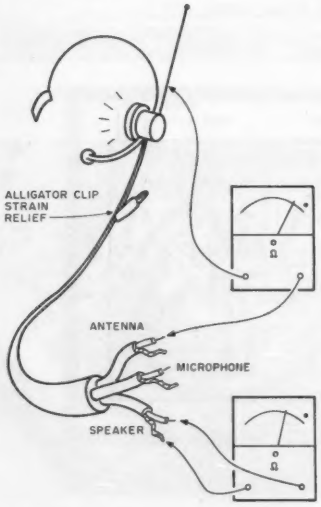

Fig. 1. Here's how to sort out which lead goes to what.

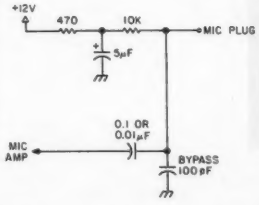

Fig. 2. You may have to bring voltage to the microphone jack.

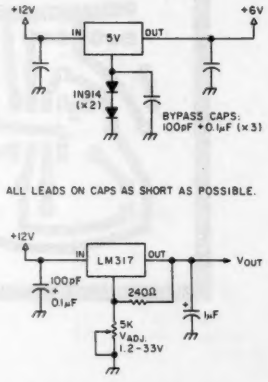

Fig. 3. Power schemes for the tape recorder.

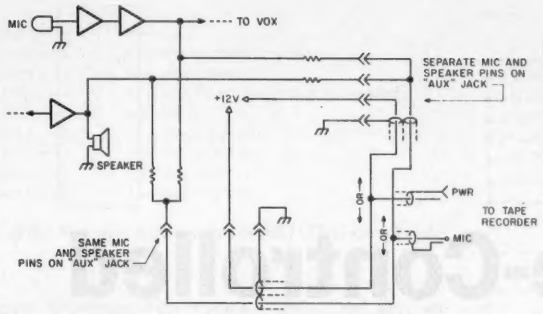

Fig. 4. Interconnection diagram.

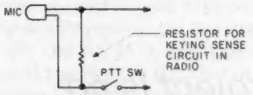

Fig. 5. ICOM's suggestion for PTT.

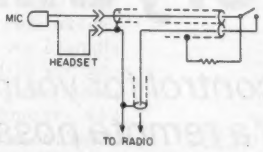

Fig. 6. PTT using the "hot" microphone lead.

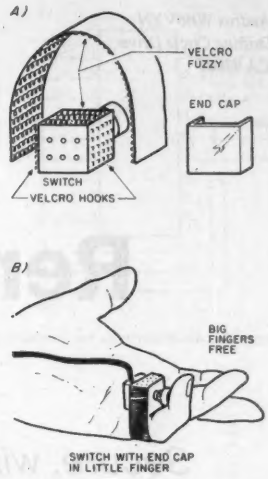

Fig. 7. (a) Remote PTT switch for an HT. (b) The remote switch in action.

run your rig in the car with hands-free VOX and a personal speaker that won't blast the wife and kiddies out of the car with the Russian Woodpecker. But you'll still want to log your contacts. I suggest an inexpensive tape recorder. Build a voltage regulator into the recorder, making sure it's well-bypassed (Fig. 3).

On the back of most ham equipment there is a jack labelled "AUX" to which is brought +12V, mike audio, receive audio (not necessarily speaker level), and so on. This can be used as the power and audio interface to your recorder.

"Ever try to work 20m sideband while driving?"

Wire it like this: The same pin on the AUX jack may be used for both receive and transmit audio to the recorder. Go downstream from the mike and find a point after the transmit audio has been amplified. Connect this point to the audio pin of the AUX jack through some high value of resistance. You'll have to experiment to find the correct value. Do the same with the receive audio (Fig. 4). You will probably end up at the speaker. With the resistors in the circuit, the receive audio shouldn't trip the VOX, even though it is connected to the transmit line, due to the high isolation provided by the resistors.

Now when you're driving down the road, you can talk to someone with your hands free, except for when you're starting and stopping the recorder. To record the time, frequency, and other information, just turn the drive all the way down on the transmitter and talk normally. The radio won't put out any power, and your voice will be recorded.

On to Two

Next, the 2m hand-held. If you want hands-free operation, you could strap your HT onto your belt and fry your kidneys. Instead, build an adapter that converts the antenna fitting of your radio to a 2.5 mm jack. Disassemble the earpiece of the headset (it usually snaps apart); inside, there is a small coil which matches the headset's antenna to 49 MHz. Bypass this with a blob of solder on the pins, and reassemble the earpiece. The antenna should be about 19 inches long, which is a good match for 146 MHz—I measured the swr on mine, and it was acceptable. On-the-air tests comparing the headset antenna with a rubber duck at waist height confirmed that the whip outperforms the duck.

Now to key the radio. ICOM suggests keying the mike ground line, but to do so would have made the headset unusable for other radios that I own (Fig. 5). I opted instead to key the positive line. I found in my junkbox a switch that fit nicely under my little finger, and wired to it a suitable length of of double-shielded wire (Fig. 6).

To keep the switch in my hand, I added some Velcro to it (Fig. 7a). Solder the braid of the coax to the switch body for strain relief and use enough wire to go up your arm and down to the radio. To keep the wire in place, I used elastic bands at the elbow and up my arm. To help with strain relief on the headset, take an alligator clip and crimp it around the wire just below the earpiece and use that to clip onto your shirt (Fig. 1). The radio goes on the belt. It's really fun to go cycling around town with this getup on. I've received some good double-takes doing this.

For the really hard-core enthusiast, you can get a mobile antenna mount, an "L" bracket, and a suitable plug, and mount everything on your external-frame backpack. A quarter-wave whip will work fine (a 5/8 will look weird) and it can double as a stainless-steel marshmallow stick. Now you can go off to the mountains, the seaside, the desert, or whatever and have emergency communications, provided you can reach a repeater. To be sure the battery doesn't freeze and die, keep it in your jacket during the day and in your sleeping bag at night.

Now all I have to figure out is how to get HBO on the Cascade Crest Trail . . . ■

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Remote-Controlled Everything

Secure, wireless control for your next project is no longer a remote possibility.

Remote-controlled garage-door openers are becoming so common now that many people, including me, consider them as much a necessity as a toaster or lawn mower. Almost all door openers use a radio link to start the motor that raises and lowers the door.

Have you ever looked at that little transmitter clipped to the visor of your car and wondered what was inside? Maybe you opened it up (after all, you're a ham, right?) and were surprised to see only a small handful of parts. I'll bet you thought, "Gee, and they want thirty bucks for a new transmitter!"

Maybe you also started thinking of all the neat uses you could have for a small remote-control system that could reach up to 200 feet or so. How about a remote PTT switch that could key up your transmitter in the shack while you stand at the antenna with the swr meter? Or a remote TV or light control?

How about a wireless doorbell for the front gate? Or maybe a beeper in the house that alerts you when the mail arrives? The possibilities are endless. The only reason you haven't done these already is because they sounded too complicated, right? After all, you'd have to build a complete transmitter and receiver for each use.

I'm going to help you build a simple, secure radio link that can be used as the basis for a very reliable home-security system, or any other use you can think of.

Look at Fig. 1. At the left is a push-button switch that powers up the rest of the transmitter when closed. The digital-coding IC sends a serial stream of pulses to the base of a single-transistor oscillator. The oscillator turns on with a high pulse, and is off between pulses. The antenna is usually just the oscillator's inductor stretched out so that it will radiate better.

This on/off signal (just think of it as fast CW) is picked up at the receiver by a superregenerative detector. Back in earlier times, many simple receivers built by hams used superregenerative detectors. They have their limitations, which we'll talk about in a moment, but it's hard to beat a single-transistor receiver for simplicity!

The output of the detector is a demodulated audio signal that is amplified and sent to a decoder IC. If the codes selected in both the transmitter and receiver match (usually set by DIP switches), the receiver IC keys a relay that stays activated as long as the proper code is still being transmitted. The relay contacts can be used to ring a bell, fire a cannon, or whatever is desired.

Encoder/Decoder Chip

Simple, right? The system's reliability is based on the digital encoder/decoder chip's ability to make sure that only a particular code will close the relay, and not random noise or other signals coded differently. Most manufacturers of garage-door and security systems use their own proprietary coding ICs that are purposely incompatible with each other. All are based on the same principle, though.

Look at Fig. 2. This is a pinout for the National MM53200 chip. It is available from several sources, such as Jameco. Pins 1 through 12 are for setting the code you want. Twelve inputs means that you can have 2^{12}, or 4096, different codes. The connections to these pins must match in both the transmitter and the receiver. Fig. 3 shows how the connections should be made. Either a DIP switch or jumpers can be used. The IC has internal pull-ups on the code input pins, so they are either grounded for a 1 bit or left open for a 0 bit.

". . . this chip set uses trinary coding with nine bits, which gives 3^9, or 19,683, different codes possible!"

Looking at the other pins, you see a 100k resistor and a 180-pF capacitor. These two parts set the chip's internal clock frequency at about 100 kHz. Use 5% components, but do not be concerned if the clock frequencies in the transmitter and receiver do not match exactly. You would have to have at least a 15% mismatch before they wouldn't work together.

If you don't have the values specified, substitution is all right. The formula for the clock frequency is 2/RC. Other values like 47k and 470 pF are fine. You can use any other frequency, like 50 kHz, if you want, as long as the transmitter and receiver are the same. The oscillator input pin can also be driven by an external oscillator. In that case, you would delete the resistor and capacitor.

Pin 15 decides whether you have a trans-

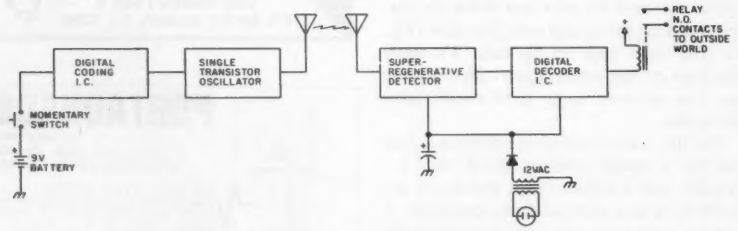

Fig. 1. Remote-control-system block diagram.

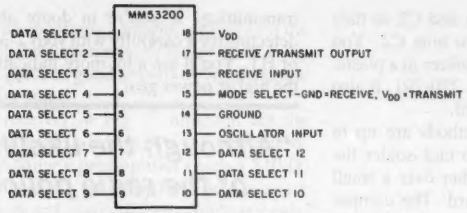

Fig. 2. Pinout of the National Semiconductor MM53200 encoder/decoder chip.

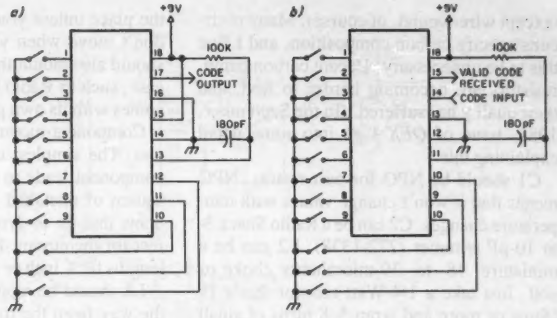

Fig. 3. Wiring the chip for: a) transmitter operation and b) receiver operation.

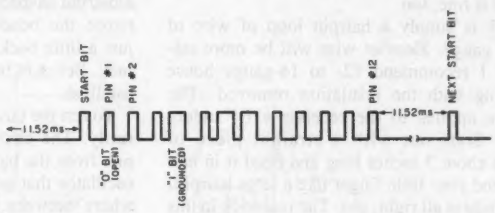

Fig. 4. Data format as sent by the transmitter chip when pins 4, 6, and 7 are grounded.

mitter or a receiver. Grounding it gives you a receiver. Connect it to the battery supply (pin 18) for a transmitter. Do not leave it open. If it is a receiver, send the data in on pin 16. If it's set up as a transmitter, the data comes out on pin 17, and pin 16 is grounded also. I recommend that you test the setup in Fig. 3 with a solderless breadboard, first. Just connect the code output, pin 17, from the transmitter to the code input, pin 16, on the receiver. Then watch the normally-high output from pin 17 on the receiver go low when the codes match. You can do that with a low-current LED or a voltmeter. Later on, this output will drive a transistor that will energize a relay.

Fig. 4 shows the nature of the data being sent and received in this system. Starting from the left, there is an 11.52-millisecond pause, then a start bit, then the twelve data bits, then another pause, then a start bit, etc. This data stream is continuous as long as the transmitter is powered up.

The start bit and twelve data bits make up one word. A word is the same length as the pause between words. The receiver chip has to see 4 words in a row that are valid (the transmitter code matches the code on the receiver switch inputs), and then pin 17 will go low. Do not try to drive an LED directly with this pin unless you use a low-current type. The pin will sink only a maximum of 2 milliamps.

There are other encoder/decoder ICs available, such as Motorola's MC145026, 27, 28, and 29. This is also second sourced from SGS-ATES. The 26 is the transmitter. There are three different receivers which vary mainly in how they treat the incoming data. The MC145028 receiver is like the MM53200 in that all of the bits are compared and a single output signals that they match. The 27 and 29 divide up either the first 4 or 5 bits as a valid address and the remaining bits as individual channel selects.

Another interesting thing is that this chip set uses trinary coding with nine bits, which gives 3^9, or 19,683, different codes possible! The code input pins are either high, grounded, or left open.

There is also a large number of TV remote-control chips from just about every IC manufacturer. These are made to operate with an infrared link, but most will work with rf. The major disadvantage with them is that they have no real security code to set, just bit patterns representing which switch on the keypad is pushed, but that shouldn't stop you from using them. Very few are used with rf links, and they are great if you need several channels with a single transmitter and receiver pair. An example would be for controlling the various movements and functions on a robot.

The Transmitter

Let's build a transmitter first. Fig. 5 shows how simple it can be. Don't be concerned if you don't have some of the exact part values specified. R1 and R2 can vary by 2:1 (don't go below 47k on R1), and I have listed most of the transistors that can work in this circuit, including one (MRF-901) that can be bought at Radio Shack. It is a real overkill for this circuit, though. If you have trouble getting parts for any of these circuits, they are available from me for a nominal cost as long as you don't want hundreds of them.

Returning to Fig. 5, we find a simple Pierce oscillator that has feedback from base to collector. Many hams don't have a solid understanding of what makes an oscillator oscillate. An oscillator is simply an amplifier tuned to the desired frequency that has some feedback from output to input.

Feedback means that a portion of the output signal is returned to the input, like the howl in a public address system when the volume is turned up too high. What happens then is that the microphone amplifies what it hears again and again. The howl is actually an amplifier being made to oscillate at the resonant frequency of the room, speakers, and microphone in combination. That's why you can get different frequency squeals by moving your hands around the mike. Your hands change the level and emphasis of frequencies heard by the mike, and therefore the pitch of the squeals you hear.

What we have to do in an oscillator is get a 360-degree phase shift through the entire circuit, and it *has* to oscillate if the transistor has enough gain. A 360-degree phase shift means that the amplified signal arrives at the base ("or collector or any other part of the loop") looking just like the signal just arriving, but delayed one full cycle.

If the fed-back signal were compared with the arriving signal on a dual-trace oscilloscope, the signals could be laid over the top of each other and they would match (except that their amplitude, or levels, wouldn't be quite the same). An old joke with rf engineers says that the sure way to build an oscillator is to design an amplifier, and vice versa! That's very true . . . feedback makes the difference.

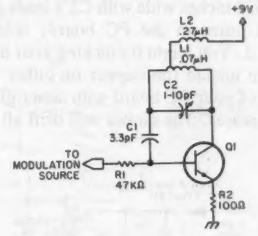

Fig. 5. The transmitter rf oscillator. Q1 can be a 2N918, 2N5179, 2N5770, 2N3563, MPSH10, MPSH11, or MRF901 (Radio Shack 276-2044).

Since we are using an NPN transistor, the base and collector are always acting oppositely, or, as the voltage rises on the base, the transistor conducts, and the voltage on the collector falls as the collector pulls more and more current. This means that the base and collector are 180 degrees out of phase, because they are acting oppositely.

Now we have half of the phase shift we need. The other half, another 180 degrees, comes from L1 and C2 in series with R1. Unless there's lots of loss through these components or the transistor doesn't have enough gain at the high frequencies we're using, the circuit should oscillate!

When you're testing this circuit, the hardest part will be finding out what frequency you're on. I'll show you how to build a simple detector to test it and make sure you're transmitting *somewhere*!

R1 and R2 are carbon film or any other type

(except wire-wound, of course). Many rf circuits specify carbon composition, and I find this to be unnecessary. Decent carbon comp. resistors are becoming harder to find, and their quality has suffered. (In the September, 1985, issue of *QEX* I go into some detail explaining this.)

C1 should be NPO for best results. NPO means that it won't change values with temperature changes. C2 can be a Radio Shack 3- to 10-pF trimmer (272-1338). L2 can be a miniature .18- to .39-microhenry choke or coil. Just take a 1/4-Watt resistor that's 1k Ohms or more and wrap 5–8 turns of small wire evenly around the body. You can use 20- to 30-gauge wire of any kind. Wire-wrap wire is fine, too.

L1 is simply a hairpin loop of wire of any gauge. Heavier wire will be more stable. I recommend 12- to 14-gauge house wiring with the insulation removed. The same applies to the receiver's L1 inductor. Start out with a straight piece of wire about 3 inches long and bend it in half around your little finger like a large hairpin. A circle is all right, too. The real trick in this circuit is to get it as mechanically stable as possible.

Ideally, L1 should be a printed-circuit trace about .025 inches wide with C2's leads going through holes in the PC board, soldered across L1. You might try tacking your inductor to an unclad (no copper on either side) portion of your PC board with super glue in several places. The circuit will drift all over the place unless you get L1 and C2 so they don't move when you go to tune C2. You should also mount the transmitter in a plastic case, such as Radio Shack's 270-291. It also comes with its own perfboard.

Component-mounting methods are up to you. The simplest is just to tack-solder the component leads to each other over a small square of unetched PC board. The components that go to ground form the mounting feet for the circuit. Keep all component lead lengths to ¼ inch or so.

L2 should be tapped on L1 about 25% of the way from the transistor base. Too close to the base, and it won't oscillate. Too far, and it gets less stable. If you've bent L1 into a hairpin shape, just put the top halfway between the bend and the base, then move just a little back towards the bend for good luck. Better to be a little unstable than not to oscillate.

To test the circuit, tie R1 to 9 volts temporarily. The circuit should draw about 5-10 mA from the battery. Now you have a CW oscillator that is probably oscillating somewhere between 180 and 500 MHz. Most garage-door-opener radios are between 290 and 400 MHz. Unless you have a spectrum analyzer (about $12,000), you won't know where you are. The circuit in Fig. 6 is a simple diode detector to show you that you're oscillating somewhere. At this point, that's all you need to know.

If you have cable TV, you can stick a short antenna into the cable converter or cable-ready TV's input, tune it to channels K or 24 (223–25 MHz) through X or 37 (301–25 MHz). Tune C1 through its full range, and at some point you should see a change in the picture or sound of the TV. Shorten or lengthen L1 if you get nothing. Please use an insulated tool. It's frustrating to watch your signal drift off as you pull your Craftsman screwdriver away. It could also cause your circuit to stop working.

The same tuning procedure applies with the diode detector. The pickup loop may have to be almost in contact with L1 before you get an indication. The most you'll see is about 2 to 7 volts. Any indication at all shows that you are transmitting. If you're in doubt about the detector, try it carefully with your 2-meter rig or HT. You'll see a lot more indication with the higher power gear.

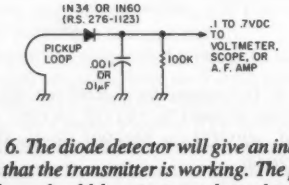

Fig. 6. The diode detector will give an indication that the transmitter is working. The pick-up loop should be one turn about the same size as the transmitter loop, or larger. Use a dc voltmeter on a 2-volt scale, or a scope. An audio amplifier will work if the transmitter signal is modulated.

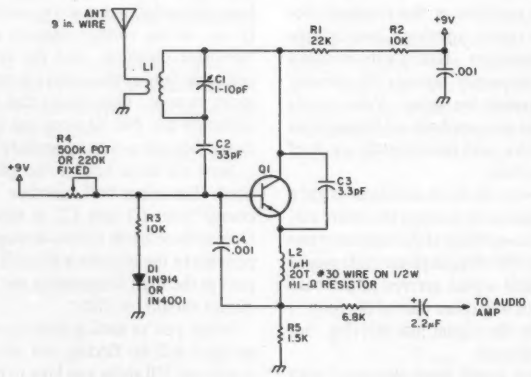

Fig. 7. The receiver. Q1 is the same transistor as is used in the transmitter. Experiment with the antenna and its coupling loop only after you have the receiver working. You should still get 100 feet or so of range just using L1 by itself.

"Although the likelihood of the radio police descending on your house is extremely small, it is your responsibility to make sure that you do not interfere with anything else."

Now that you have your transmitter working, smile smugly at your abilities and go to work on the receiver. You might also connect R1 to pin 17 of your code-transmitter chip and observe the code being sent on an oscilloscope connected to your diode detector. Or you could connect the detector to an audio amplifier and hear the musical buzz the code chip makes. It may also make some interesting viewing on your television!

A Super- What?

Superregenerative detectors are still used today in a variety of things such as radar transponders, aircraft altitude-measuring radar, police radar detectors, inexpensive radio-controlled toys and walkie-talkies, and garage-door-opener receivers. The main reason they are used is because of cost and circuit complexity; it's hard to beat a one-transistor receiver. Their main disadvantages are that they are limited mostly to AM and pulse detection. They also tend to emit quite a bit of rf. This can be controlled somewhat by isolating the detector stage from the antenna with a preamp.

Looking at Fig. 7, you might think that you're looking at an oscillator circuit. We have the Pierce-type tuned circuit connecting between the base and collector of Q1, just like the transmitter we built. The main difference here is that we connect C4 into the circuit and it, along with L2, R3, and R4, form another low-frequency oscillator at about 200 to 700 kHz. If you have the interest, you could disconnect C4 and observe that you now have a single frequency oscillator just like the transmitter.

A superregenerative detector is basically an oscillator that is rapidly turned on and off. This circuit turns *itself* on and off, so we call it a self-quenching detector. You could also turn it off and on externally with a sine- or sawtooth-wave generator connected to the transistor base through a small choke. Square waves are not desired here as they spend little time in transition (the time between fully on, or a logic high, and fully off, or ground). During the transition period, and when the transistor just begins to conduct, amplifica-

tion of an incoming signal is achieved on the order of a *million* times, or more! That's why we can get such good sensitivity from a single amplifier stage.

The receiver in Fig. 7, although not the best, can hear signals as low as 3 to 5 microvolts. Adding a preamplifier (even a $10.00 Radio Shack TV amplifier) will help increase sensitivity and also cut down on detector radiation through the antenna. For long-term use, I recommend doing this and also putting the entire receiver in a shielded enclosure.

Why not use a superheterodyne receiver, with sensitivity down in the .2-to-.5-microvolt range? Cost, complexity, and attention to the vagaries of careful rf layout come to mind. Also, you don't need the narrow bandwidth achievable with the superhet here. The transmitter will drift as much as 2 MHz under handling and tuning, and you're going to have enough concern just finding the transmitter signal at first. You don't need razor-sharp tuning right now.

Building the Receiver

Let's look at Fig. 7 again. L1 is another loop of stiff wire, or firmly mounted smaller gauge. The antenna and its coupling loop shown in the schematic are optional. The coupling loop should be another single turn lying next to L1 on the PC board about ¼ to ½ inch away. I recommend you just worry about L1 initially, and experiment with the antenna later. The pot, R4, can be replaced with a fixed resistor after setting the quench frequency to about 300–600 kHz, as measured by a scope or frequency counter at the junction of R1 and R2. That's why we have the two resistors there instead of a single 33k resistor.

If you don't have a scope or counter, you can still make this circuit work fine. You'll need a medium- or high-impedance audio amplifier. I recommend one anyway, and I even use one myself. I have a little box with an LM-386 IC and a 9-volt battery. You could do a lot worse than the one Radio Shack sells for $11.95 (227-1008). It's the same thing, basically.

Connect the amplifier up to the audio output point shown as you tune R4 through its range. C1 should also be turned if nothing happens, or put it in the center of its range. You are listening for the characteristic rushing noise, or hiss, that tells you the detector is oscillating. If you hear nothing, touch the transistor base with your finger. If you don't hear a slight hum or squeal, then there is something wrong with the dc connections of the transistor, such as R4, R3, D1 (it's not backwards, is it?), L2, R5, or R1 and R2. Or maybe the transistor itself is connected wrong.

You may hear squeals and burps, but somewhere you'll hear the hiss. You might also try shortening or lengthening L1, which is just about the same size as L1 in the transmitter. If you turn on your unmodulated transmitter, the hiss will suddenly quiet down as it's tuned to the receiver. If you connect up your code-generating chip to the transmitter as I suggested, you'll hear the musical buzz in the receiver. At this point you have a working receiver.

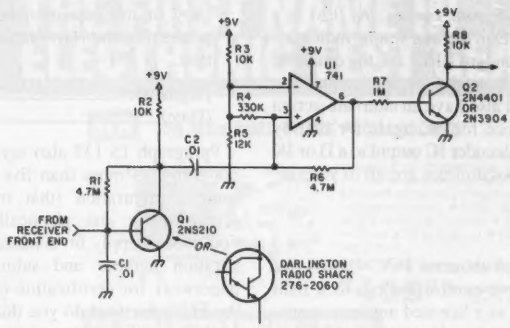

Fig. 8. The audio amp, comparator, and inverter. Use a 2N5210 if possible, or a Darlington such as Radio Shack 267-2060, an MPSA13.

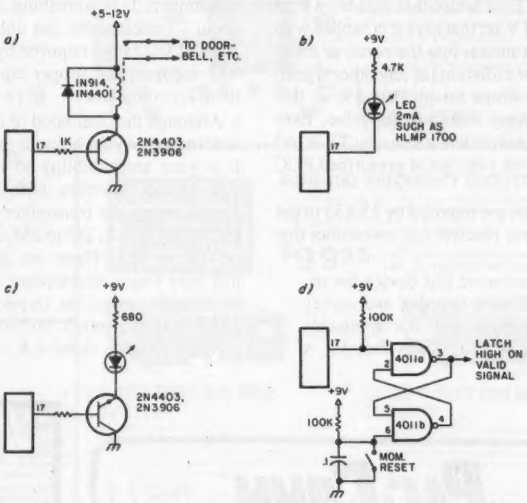

Fig. 9. Various ways to connect the decoder-chip output to the outside world. a) Driving a relay. b) Using a low-current LED. c) Using a regular LED. d) Providing a latched output. Pin 3 of the 4011 flip-flop latches high on receiving a valid radio signal.

By changing the value of L1 and C1, you can make this receiver work on just about any frequency. Now all you need is a circuit that amplifies the signal sufficiently so that the receiver chip sees nice, square 9-volt pulses.

Look at Fig. 8. The low-level audio signal is amplified by the 2N5210 transistor. This is a low-noise, high-beta (about 250–500) transistor. Use it if at all possible. You could also use two NPN units connected as a Darlington pair, or Radio Shack's 276-2060 Darlington. You should then change the base bias so that the transistor collector idles at about 4.5 volts (not critical).

Use a high-value resistor, above 500k, from Q1's base to ground to limit conduction of Q1. C1 cuts down on the amount of the high-frequency quench signal that is amplified by Q1. U1, a 741 op amp, is used as a voltage comparator and Schmitt trigger. It toggles between 9 volts and ground (almost) with a signal greater than about .3-volts input. Q2 then inverts this signal back to what it was at Q1's base.

Check and see that the Q2 collector swings less than 2 and greater than 8 volts. If it doesn't, change the value of R7 till it does. This can be verified with a scope at the collector when the receiver is receiving pulses, or by temporarily shorting pin 3 of U1 to 9 volts and ground.

Now you have a working system. Connect up the decoder chip and, with a VOM or scope, watch the normally high output pin 17 go low when it gets a valid signal. Make sure that the codes are set the same on the receiver and transmitter. If it doesn't work, look at the signal at the output of the transmitter chip. The wider pulses correspond to grounded code-selection pins 1–12. There should be very little other noise or few glitches on the received signal as the decoder chip sees it.

Output Connections

Fig. 9 shows several suggestions for connecting the outside world to the receiver. At 9(a) is the setup you'd use to replace your present garage-door receiver. Just connect the normally-open contacts of your relay across the external push-button

contacts on your door opener. At 9(b) is a low-current LED to use as a simple indicator. If you have a standard LED, use the circuit of Fig. 9(c). If you need a latched output, use 9(d). You could also have an alternate-action output (push once for on, again for off) by connecting the decoder IC output to a D or JK flip-flop. The possibilities are up to your ingenuity.

Is It Legal?

Finally, a word about the FCC. Unless you tune your remote-control system to a ham band and use it as a licensed amateur, transmitter and receiver use are controlled by Part 15 of the FCC's rules and regs. Part 15 covers all low-power, unlicensed radios and computers capable of emitting radiation into the airwaves. Ever notice that sticker on your FM radio or TV set that says it complies with Part 15? That means that the receiver emits local oscillator radiation (or any other signal) that is below limits set by Part 15, so that nobody interferes with anybody else. Ever listened to 80 meters when a nearby TV is on? It interferes with you, but at prescribed FCC limits!

Anyway, you are required by 15.133 to put a sticker on your receiver and transmitter that says:

> I have constructed this device for my own use. I have tested it and certify that it complies with the applicable regulations of FCC Rules Part 15. A copy of my measurements is in my possession and is available for inspection.
>
> (Signature)_____
> (Date)_____

Paragraph 15.133 also says that you cannot construct more than five devices of the same configuration (that means identical schematically and physically). Otherwise you need to apply for a manufacturer's registration number and submit the proper paperwork for certification of the device to the FCC. So what do you do? The units described in this article can easily be made to radiate more signal, either fundamental or harmonics, than they should. The amount of radiated signal is very small, even for the transmitter. It is something on the order of about 20 microwatts, but unless you have a 3-meter test range required by the rules, you will not have the proper equipment to test them for compliance.

Although the likelihood of the radio police descending on your house is extremely small, it is your responsibility to make sure that you do not interfere with anything else. Avoid tuning the transmitter to MHz ranges 242.8 to 243.2, 265 to 285, 328.6 to 335.4, or 404 to 406. These are forbidden areas that may cause interference to government or aircraft navigation (especially 328.6 to 335.4 near an airport). To avoid all this, tune yourself to cable channel K, which is in the 220-MHz band, or channels 57 to 61 (hyperband), which is in the 70-cm band. The possibility of interfering with any repeaters is almost nil, due to the very low power used here.

Conclusion

It is possible to make these units fit in a very small space. I used 2″ x 3″ board stock for the receiver and 2″ x 2″ for the transmitter, with room left over.

If you have problems getting your setup to work, get in touch with me. I will even fix your project in the event you can't get it going. Please include proper return postage for whatever you send. A semi-kit is also available from me for $15.00. This includes all the parts needed for one transmitter and receiver pair, less case. This kit does not include etched PC boards, but does include blank PC stock to tack-solder the components to each other.

Etched boards may become available if interest is great enough. I can also supply individual parts, such as the coding ICs and the 2N5210, etc. Contact me for price. SASE, please, for all correspondence.

If you're interested, I can also direct you to a dealer in your area who can sell you units manufactured by Linear Corporation that are tuned to 310 MHz—I can get them direct for you. The cost for a single transmitter and receiver pair should be about $45.00. ■

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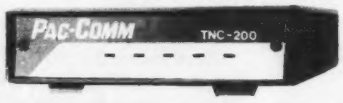

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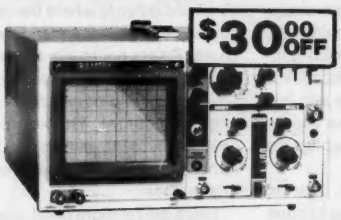

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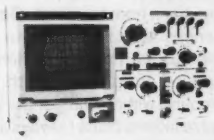

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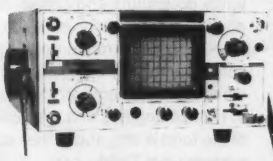

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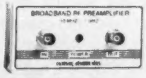

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NEVER SAY DIE

from page 10

bers get all involved in some really inconsequential matter—but then, for some reason, there are fewer and fewer turning out for subsequent meetings. Suddenly the club drops below critical mass and it's gone. I remember one club I used to go to which had one hell of a session over what color to paint the clubhouse. I don't think the club ever really recovered.

Check with the members and see what they think is fun. I'll bet you find the part of the meeting when they're able to stand around and talk with friends is right up there on top. The feeding frenzy is another winner. In addition to the fun of eating there's more talking with the friends. But how many clubs put off the feeding until the end of the meeting? Most!

It's fun to get in someone who can give a rousing talk. Sadly, we haven't many rousers in hamdom. If you've got a ham firm in your area, you might try inviting the entrepreneur involved. In general, entrepreneurs are interesting. They're all wrapped up in what they're doing. You must have a manufacturer or seller of some kind of ham gear within commuting distance to liven up meetings. Buy him a dinner and bring in the biggest crowd you can for him.

Another potential entertainment for your club meeting (party) is a member who's a fanatic on some aspect of hamming. You've got 'em, so dig 'em out, brush off the dirt, and have 'em explain why they're a nut case over slow scan, packet radio, OSCAR, high-speed CW, or whatever insanity has pushed them over the edge. Show and tell.

I suggest you do all you can to keep your parties clean. Keep alcohol out. That's right, kill the 807s. Alcohol does different things to different people, but it has one action in common for everyone—it makes you stupider than you were before you drank. Of what value to your club are a bunch of stupefied members falling asleep? Alcohol quickly lowers the level of awareness, making some people laugh more, and some more surly. You don't need either of these to spice up a meeting. No beer.

With a growing percentage of the population angry over smoking, bar it from meetings. Get your serious addicts to make a short trip outside to smoke when they can no longer live with their nicotine withdrawal pangs. When I give talks to clubs I always ask for no smoking—and I generally get a round of applause for saying it.

Instead of having the club entertainment committee buy cheap junky doughnuts and coffee, how about getting members' XYLs involved? Get members to bring in some munchies, dips, and other dishes for the meeting? I've been to clubs doing this and the quality of the food is way above the usual supermarket Twinky crap.

Solving Problems

Once you have your club growing, you're going to be able to start dealing with local ham problems. Have you got a TVI committee yet? No ham should ever have to handle his own TVI miseries. Any TVI complaint should be tackled by the club TVI committee—first checking the ham station to make sure it's clean. Next the committee should visit the complainer, give him a printed form explaining the whole situation in lay terms, and then attempt to get past the accrued anger to work toward a solution. Has your club a printed information sheet explaining TVI? Let me see it so I can publish some of the better ones to help other clubs. Heck, if there's a demand, I'll even get my print shop to print some up which can be bought in bulk.

The next thing you need is a committee to tackle repeater problems. If there is a statewide repeater alliance, fine, get one or two delegates from your club to attend their meetings. Even if your club doesn't have a repeater, which is unlikely these days, your club still has a strong vested interest in local repeaters being operated well.

Your club also should be in touch with the local repeater coordinating group and make sure they know you're watching them. If they start screwing up, call 'em in to explain at your next meeting. The repeater alliances and coordinating committees are only as strong as the clubs which support them.

It has not been satisfactorily determined as yet as to whether people become hams because they are crazy or whether hamming makes people crazy. We do know that, with the sole exceptions of you and me, all hams are crazy. On this premise, you shouldn't be surprised at anything which happens in amateur radio. The trick is to gear your club to cope with this craziness—with both the copers and copees being accepted as crazy.

My suggestion is this: Just as you have a TVI committee to cope with irate television owners—or hi-fi, hearing aids, etc.—you should put together a small A-Team to tackle local repeater jammers and other such trouble-makers. I like the A-Team concept—a small group of dedicated individuals, all with sneaky brains aiming at outsmarting the bad guys, but with no bloodshed. Have you ever noticed that the A-Team can shoot from the hip with a machine gun from a bouncing van at night and shoot a rope in half at a hundred yards with the first round, yet not in several years and hundreds of thousands of rounds have they ever been able to hit a bad guy? I don't think they've even winged anyone! So get your A-Teams going and make sure they don't aim for the kneecaps (like I might). Hey, I'm talking figuratively, in case there are any old farts who suddenly want to take me seriously in order to righteously put me down. I already mentioned how many nut cases we have in our blessed hobby—except, as I said, for me and thee—and I'm not entirely sure about thee.

The ham who is so determined on screwing up amateur radio for the rest of us that he ignores the first visit or two from your A-Team will call for strategy. Perhaps a mass visit from the entire club, with or without flaming faggots and pitchforks? Bring plenty of marshmallows in case the house burns by accident from a flying spark. Figuratively speaking again, of course (heh, heh, heh).

Self-Policing

The A-Team approach via local clubs will help a good deal to clean up our act. We do have to be wary of officious self-appointed police. They can cause more problems than they solve. The ARRL had a good idea with their Official Observers, but all too often OOs got carried away with their work and went overboard. I think we need something along that line—hams with the time and patience to act more like corner crossing guards than police. A polite reminder that someone is operating in the wrong subband. A suggestion that the mike gain or the compression be turned down to where the voice can be deciphered. A plea to well-known DXers not to jam the weak DX station once they've contacted it so as to keep others from getting the country. These are all delicate matters, calling for tact rather than the often used verbal rubber hose.

There are far more good guys in amateur radio than bad, so if the good guys use the strength of working together, they (we) will prevail. By the way, the bad guys know who they are. They are defensive about it, but they know they are the bad guys. Most of them are emotional basket cases that use being bad as a way of getting attention—like a bad child. We don't have the resources to put these jerks under psychiatric care, where they belong, so we just have to learn patience and deal with them one by one.

The Future

As we are able to bring our clubs up to strength—with representatives from each working with the area repeater councils—the next step is for us to get going with a national meeting every two years, with two delegates representing each ham club, to discuss and vote on needed rule changes.

As with the Geneva ITU meetings, this group should first break into working committees to discuss each proposed change. The committees would then report their decisions to the group as a whole—the plenipotentiary—for their vote. This vote would be binding and automatically enacted by the FCC. I've discussed this with the FCC commissioners and found them enthusiastic.

This would have many benefits for us—and the FCC. It would save us years in making our rules reflect the state of the art. In the past, virtually without exception, we amateurs have done our best with a minimum of rules. But we've always had a nut case or two who flatly insisted on getting the FCC into the act. I don't think anyone can remember a time when the resulting rules were needed or appropriate. I've always advised experimenters and pioneers not to ask the FCC when there is any question. If something is not specifically prohibited, then it is permitted, so go ahead and do it. Asking a government bureau-

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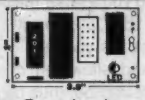

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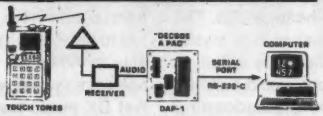

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crat to go out on a limb by authorizing something which has not previously been specifically authorized is incredibly dumb. The easiest answer is no, so that's what you get. Don't ask.

Getting our clubs involved with proposed rule changes will help develop more interest in the clubs and amateur radio. It'll give club newsletters a lot more to cover—and perhaps even make ham magazines more interesting. Right now a very small vocal minority has an outsized effect on our rules.

Executive Summary

So there you have it—the FCC hasn't the time or the money to deal with amateur radio. We need to take responsibility for ourselves. Remember, with Gramm-Rudman, it isn't going to be the 70% of the budget for entitlement payments which is going to get cut, it's going to be government bureaus like the FCC, so they're going to be able to do less and less for us.

It's time for amateur radio to face this situation and accept the responsibility. We've got to organize for the growth we need. We've got to build more and stronger clubs. We've got to organize for the growth we need. We've got to build more and stronger clubs. We've got to recruit and train new hams—and get older ones enthused to do more.

We don't need Big Brother for anything, so let's get moving toward cutting the umbilical cord.

TRANSMIT MUSIC—LEGALLY

Yes, at long last you can legally transmit music on the ham bands! However, before you start plugging your record player into your mike jack, you'd better read further. A lot further.

Now, all you youngsters sitting around old Doc, let me tell you why music is prohibited on the ham bands. You see, back before World War II, way back in the 1930s (yup, I was there–I'm a living monument to the past) we had two basic classes of ham licenses, Class B and Class A. To get the Class A license, the advanced radiotelephone license, you had to pass a stiff (for then) technical exam on radiotelephone technology. Whew!

The Class B ticket was pretty much like today's General license, complete with 13-wpm code. But 90% of the Class B licensees operated only CW. The Class A ticket allowed you to operate in the 75m and 20m phone bands, each 100 kc wide (kHz hadn't been invented then). AM phone, it was.

Class B could operate on 160m and 10m phone. Well, 10 was a VHF band then and almost completely unused. Experimental. So the B-ops either operated CW or hung out on 160m phone. 160 was a big band then, running from 1800–2000 kc—later expanded to 2050. We even had an almost totally unused CW band from 1715–1800.

40 was the big one. It was CW only and packed solid. Everyone used crystal control, so the practice was to call long CQs and then tune for minutes up and down the band. You could expect a call from *anywhere* in the band. It wasn't until variable frequency oscillators came along (vfo's) after the war that one tuned near one's own frequency.

DXers fought it out on 20m CW. Traffic nets and rag-chewers were on 80 CW, which ran from 3500–3900 kc. The B-ops on 160 mostly used simple homemade rigs. The most popular was a 6L6 crystal oscillator modulated by a 6L6. In the cities 160 ops would build afternoon groups rebroadcasting each other from one end of 160 to the other so everyone in the group could hear everyone else. Sure, six ops would tie up six frequencies, but heck, there weren't enough of us so it made any difference, even in New York City. We called it duplex operation. At night 160 was too crowded for this as stations from the whole East Coast would be heard.

But then, as today, no sanity exam was given, so we had as high a percentage of crazies as we do today. Some of these boneheads would get on 160m and play records all afternoon. Eventually the FCC got fed up with this crap and passed a rule which made it illegal to transmit except for the purpose of communications. This meant no one-way transmissions (except by W1AW), no blank carriers, no music, and, sadly, no more duplex.

Of course duplex today on most of the low bands would be too wasteful of frequencies. Remember, we went into World War II with only 50,000 hams. Remember, too, 40,000 of us joined the military! Without us our country would have had a lot tougher time. It was electronics which did much to win that war.

Now, getting back to a legal way to transmit music on any ham band. Have you figured it out yet? Simple, really. Just consider what's happened with digital audio. Our compact discs are merely encoded with digital data which a computer can translate as music. It's those old zeros and ones, just like any digital communication.

So, as long as you send the digital information over the air, it doesn't make any difference whether a computer translates it into words, music, or pictures.

Hold it. Don't plug your CD player into your mike jack either. Your player has a built-in decoder so you get analog out. Music. You need a CD player with a digital output—like we're starting to see for CD-ROM use. Here's one more dash of cold water: Since digital audio is sampled at 44 kHz, you're either going to have to transmit a very wide band to send it in real time or else slow it down the way we do with SSTV—so you don't take up too much bandwidth. Okay, so it could take ten hours to transfer a one-hour CD. You want to bet some damned ham somewhere doesn't do it just to prove it can be done? Probably to Africa on 20m too. Anyone want to offer an award for the first DX music transfer on 20m? Let's keep it to the "Minute Waltz," okay?

If you're interested in digital audio, guess what? I also publish (surprise) a magazine called *Digital Audio*. It's going gangbusters—devoted mostly to reviewing new CDs and CD players. It should be on your local newsstands. If you have a CD player, you really can't get along without the magazine. You see, far too many of the new CDs are disasters—and, at around $12 each, it doesn't take many bum CDs to more than make up for a subscription to *Digital Audio*. We review a hundred or so CDs in some issues.

Let me know if you try sending digital music, okay?

WESTLINK WINS ONE

Bill Pasternak WA6ITF's *Westlink Report* got the news out accurately on *73*'s move to WGE from CW Communications. Good work, Bill! The staff changes, cited as major by W5YI, were less than that, as can be seen by checking old *vs.* new *73* mastheads.

Perry Donham KW1O is back as Editor after a short stint at *inCider* Magazine. Steve Jewett KA1MPM is here, too, taking on the task of Production Editor, learning our state-of-the-art computer production system. Chris Schmidt came on board last week as Managing Editor. The rest of the staff is the same. . . International Editor Dick Phenix, Editorial Assistant Carole Macioci, Art Director Dianne Ritson, Designer Susan Hays, and Marketing Manager Hope Currier.

Jim Gray left, moving to *Modern Electronics*, I understand. Nancy Ciampa moved up to Sales Manager. Stu Norwood, who edited *73* several years ago, is back. Several other past *73*s staffers are also back with the magazine: Bruce Hedin, Sara Bedell, Bill Heydolph, and Tedd Cluff.

The only major change was me replacing Publisher Burnett and Executive Editor Philbrick so I will be able to give *73* the direction I think you want. Mind you, it'll take a few months to get *73* the way I think it should be, but with your help we'll not only have a fun magazine to read, but we may be able to get our hobby growing again—something it hasn't done much of for over twenty years.

It takes an enormous amount of work by a lot of people to get you *73* every month. We're all working for you—to help make amateur radio more fun for you. It's you who write the articles we publish. It's you who subscribes—and remember most of your subscription money goes to our beloved postal service. It's you who buy the ham gear and services advertised in *73*, and it's these ads which pay most of the freight. If you buy more, we are able to sell more ads and bring you a fatter magazine. If you don't buy, all you get is a lousy pamphlet. It's you who urge your friends and fellow ham club members to subscribe, thus helping *73* to grow. All I can do is sort out the articles I think you'll want to read and write editorials you'll enjoy. . . or hate. My basic goal in life is to educate, so you'll find my editorials make you think—and you'll find plenty of articles aimed at helping you understand our fast moving technology.

Yes, I know about those old curmudgeons who hate Wayne Green. There will always be a few people who don't want to think. . . don't want to learn. . . who hate change. They're always going to find me disturbing. But I'll bet you find them as miserable to deal with as I do. . . as even their family does.

I have a psychological problem you have to deal with. So you might as well recognize it. This is my drive to get others to enjoy the

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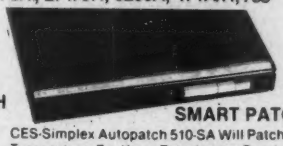

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things I enjoy. Whenever I find something fun to do, I'm right out there doing my best to get others to join me in the fun. That's one of the reasons I started *Byte* magazine ten years ago. That's why I was such a nudge about FM and repeaters 17 years ago. That's one of the reasons I started *Digital Audio* magazine. That's why I'm trying to organize a yearly DXpedition. Heck, that's what got me into ham publishing in the first place, 35 years ago... and pushed SSB so hard 30 years ago.

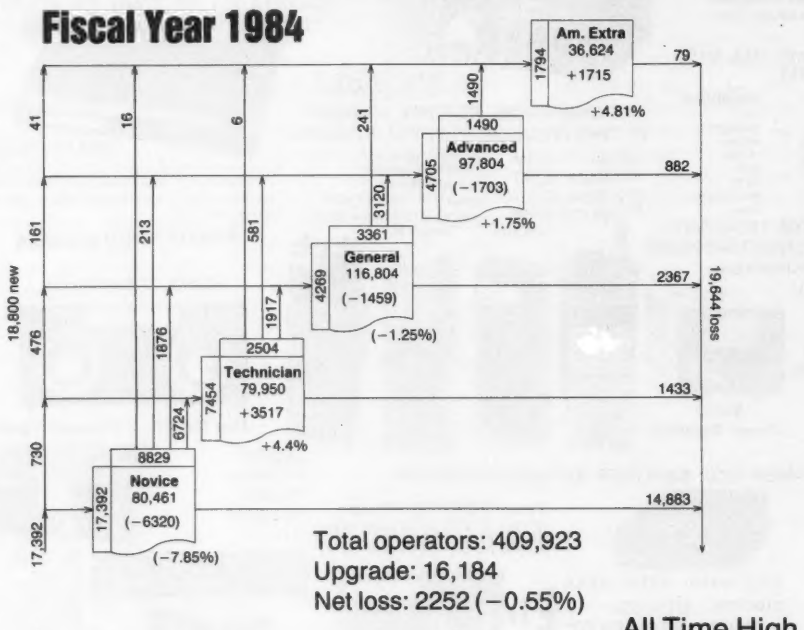
I was having such a ball with ham Teletype that I wanted to get others to try it and see how much fun it was. You know, hundreds of thousands of people are doing almost the same thing today with the computer bulletin boards and networks. They're sitting there, hooked by the phone wires, talking with each other. If word ever leaks out that they can do the same thing for free via amateur radio, we could be inundated.

I got interested in RTTY back in 1948 and took to it immediately. I found that communications via a keyboard made for much more interesting conversations than most CW or phone contacts. It takes a little longer when you type, but it also somehow brings out a lot of a person's personality. I found many hams who were deadly bores on phone to be clever and thoughtful on RTTY. The computer network users are finding the same thing today—as are the packet radio fanatics.

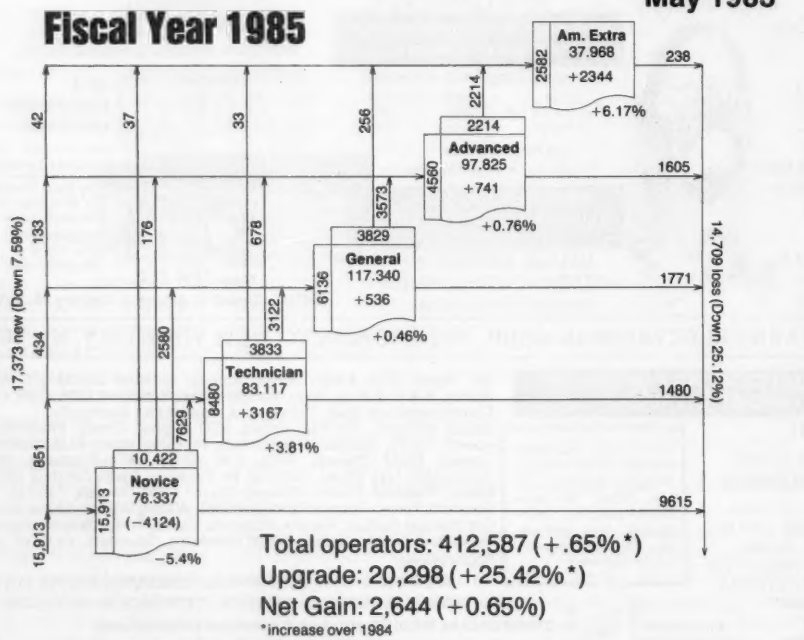
Say, if you've got a C-64 computer you might want to try one of these land-line nets and see how they work. I visited the people at Playnet the other day. Their system allows people to gather in small groups—up to six usually—and talk via their C-64 computers with each other. No restraints. If you'd like to give this a try, let me know and I'll send you the operating package, complete with disks, for $20. You could do worse than get involved and start getting the others on the net interested in hamming.

Playnet uses digital phone lines instead of voice quality, so it's a lot cheaper to use than regular phone calls. Let me know how you do. Also, let me know if this doesn't push you over the edge into packet radio.

Send a $20 check or your credit card number and expiration to me and I'll get you the Playnet package pronto. You do have to have a Commodore C-64 computer.



All Time High
May 1983



Amateur statistics for FY 1984 and 1985.

THE FCC FIGURES COVER-UP

Why some ham publishers go out of their way to cover up the licensing disaster is difficult to understand. The miserable fact is that the number of new hams licensed in 1985 was down from 1984—which was down from 1983.

If you'll check the FCC licensing charts published here you'll see that the number of Novices licensed in 1985 was down 8.5%! This is even worse than the 1984 drop of 7.9%. The situation is not getting better.

The slight increase in the total number of licensed hams (0.65%) was due to a small decrease in the number of Novice dropouts—due in turn to the effect of longer licensing terms.

If you're a fan of emphasizing the shreds of good news amongst the bad, you'll see 15% more Novices upgraded than in 1984. This helped push the total number of Novices down by 5.2% (despite the decrease in Novice dropouts, which buoyed up the Novice total). The dead-end Technician class "surged" ahead by 3.9%, while the General and Advanced classes hardly changed.

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40	Yaesu Electronics	Cov. III

* Please correspond with this company directly.

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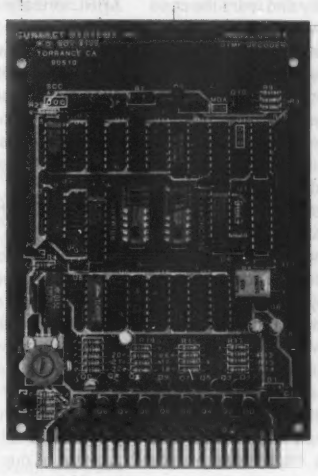
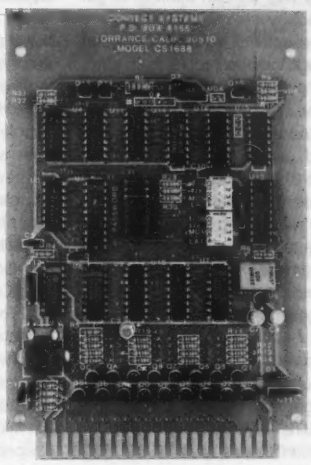
MODEL CS-16 $164 Amateur net | **MODEL CS-1688 $189** Amateur net





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	D 1 2 3 4 5 6 7		8 9 0 * # A B C
	D-7 GROUP		8-C GROUP
1.	8 LATCHED	and	8 MOMENTARY
2.	8 LATCHED	and	1 OF 8 SELECT
3.	8 MOMENTARY	and	8 LATCHED
4.	8 MOMENTARY	and	1 OF 8 SELECT
5.	1 OF 8 SELECT	and	8 MOMENTARY
6.	1 OF 8 SELECT	and	1 OF 8 SELECT
7.	1 OF 8 SELECT	and	8 LATCHED
8.	16 LATCHED		
9.	16 MOMENTARY		
10.	1 OF 16 SELECT		

COMMON FEATURES

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Model CS-10 DIP relay board...packages 10 DIP relays.

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It is difficult to put a good face on what's been happening. I suppose the positive way to look at it is to rejoice that QRM will continually decrease as the *QST* "Silent Keys" column gradually eats its way through the U.S. *Callbook*. We'd better start brainstorming every way we can think of to get our hobby into gear.

The activity in Japan may be enough to keep the ITU from gradually paring down the ham bands. As the U.S. activity dwindles, the Japanese are picking it up. I wish I could get someone to translate some of the articles I'm seeing in the Japanese ham magazines. They're building all sorts of great gadgets there. Their magazines are packed with construction projects and pioneering ideas. I've got some friends there; I'll see what I can do. Of course, since we're building less these days it's difficult to get parts. Maybe we can get someone to start importing parts. If you ever get to Tokyo you don't want to miss the Akihabara section, where there are hundreds of stores selling electronic parts and gadgets. It's ham heaven—swarming with thousands of Japanese youngsters shopping for parts. Maybe someone could build a mail-order parts business here if we can get youngsters back into amateur radio.

Speaking of youngsters, a survey of the ages of the newcomers last year showed that 16% were teenagers, down from the 75% we had in the 1950s. To put that into comparative terms, we used to generate about 12,500 high-tech-career youngsters a year and now we're providing about 2,200—about 18% of what we did a generation ago. 'Tain't much.

How are you doing on getting youngsters into your ham club these days? If you're having any success, how about writing the details so I can pass them on for other clubs? Also, if you have any success in convincing youngsters to learn the code, please let me know how you did that. Most kids I've met recently think the code is stupid and those who argue for it are obviously brain damaged. Maybe it's really true that rf can cause serious mental problems.

I personally used to love the code. I adored it. I grew to love it when my Morse-code tapes were selling a couple thousand a month at $5.00 each. I think I'll make a new set of tapes and fall in love all over again. So let's keep that old code test in there so I can make plenty of money with my tapes, okay?

I won't tell you which of the ham magazines is selling the worst code tapes in the world. Scientific studies have clearly shown the enormous differences in code learning methods. The worst possible way to try and learn the code is one which a certain organization has been pushing for years. I used their system and managed to take a couple years to learn the code their way. Now days many people are learning it in a day or two—some in a few hours, using the new, modern, scientifically researched system.

Hint: This is essentially the same learning system I used with the code tapes I made ten years ago. One key element is to send each character at 13 wpm, even if you only want to copy 5 wpm. That way you train your brain to recognize the sound pattern of a character just once and you don't run into the speed plateau which I suspect has kept more people from getting ham tickets than have succeeded.

A few tests have been made with people starting to learn code at 20 wpm right off the bat. The early results seem to indicate it is no more difficult to learn 20 wpm than 13 wpm—hardly takes any longer. The main problem with 5-wpm code is the temptation to set up a table in your mind and look up each character as you hear it. Dah-dih-dah-dah, hmmm, oh yes, that's a Y. You can do this up to about 10 wpm; then the speed limit for shuffling data manually in your brain is reached and you're stranded up the well-known creek which runs from the code plateau. If you start out at 13 or 20 wpm you never see the plateau and the only paddle you need is on your speed key.

Maybe the ARRL was right when they were fighting the Novice license proposal years ago—but for the wrong reasons. It may be that the 5-wpm code test has hurt amateur radio more than it's helped. The League sure hated the idea of the Novice license, though they fought it because they hadn't proposed it and they were busy trying to keep total control of the rule changes—as they had had for many years before that.

George Sterling W1AE was the FCC chairman and he was bound he was going to get amateur radio to progress, no matter how hard the ARRL's general manager Budlong fought. George prevailed, so we got our Novice- and Technician-class licenses. As a matter of fact, for several years the ARRL lost every petition they put in for rule changes—and fought every single one they didn't put in. That perhaps made up for the earlier years when the ARRL virtually wrote all the ham rules.

I remember when I became editor of *CQ* in 1955. I visited the FCC Amateur Division and was told that Budlong had been asked to never show his face there again. The ARRL's Washington counsel, Segal (no call), was just as popular there. Oh, that's enough reminiscing. But I'll bet few old-timers had any idea of what was really going on between the League and the FCC—any more than they do today. Hint: The no-code debacle put a very heavy strain on ARRL/FCC relations, as also did the VEC situation.

Vic Clark, the previous ARRL president, and I got pretty close as a result of our work together on the FCC's Long Range Planning Committee. He was almost as upset as the FCC over the no-code disaster and complained bitterly about the room-temperature IQ of some ARRL directors he had to work with.

I have confidence in David Sumner, the present general manager. No, by golly, they've done away with the general manager title and David is the executive vice president. I wonder what the difference is? Anyway, he's a nice chap and has my confidence, as does Chris Imlay, whom I worked with a few years ago when we were both on the FCC's National Industry Advisory Committee for amateur radio. Things may be looking up.

I used to know everyone at ARRL HQ very well, but as I'm sure you've read in *The W5YI Report*, things got pretty bad for a while, so just about all the old hands quit. There was even talk of an employee union. You know, it may be getting time to restructure the ARRL and bring it up to date. It hasn't changed much in the 50 years I've know it—and I've been a member for 48 years. Both the ARRL and amateur radio would benefit if the League were brought into the 80s.

Imagine what our country would be like if we were trying to run it with nothing but sixty-year-old laws. Yes, Hiram Percy Maxim, the chap who founded the League and set it up in its present form, was a genius, but the world—and amateur radio—has changed a good deal since he died fifty years ago. Percy was also an automobile and film pioneer. I wish I'd known him.

Why do I write so much about the League? Well, they're there—and they're interesting. Also, it isn't possible to write about amateur radio and *not* write about the League. It's like writing about the United States and not mentioning the government.

I often get accused of hating the League. If you run into anyone who has that impression please ask 'em where in the devil they got such a weird idea. I've never hated the ARRL. Never loved 'em either. I try to be pragmatic, taking 'em to task when they seem to be screwing up—complimenting 'em when they do something right. Somehow my compliments seem to fall on blind eyes.

You know, when I take the FCC to task I never hear anyone beefing that I hate the FCC, yet I've been on their case far more than the ARRL. I reserve the right to be sarcastic and snide about the FCC, the ARRL, lids, the QCWA, the OOTC, and any other group which I think needs a good hotfoot for some reason.

KEEP THOSE...

Attention DXers: In case you're ever looking for something to talk about when you manage to snag a ham in a rarer country, how about suggesting they send reports now and then to the *"73* International" section? There are all sorts of things we're interested in knowing. For instance, a lot of us travel, so we're interested in knowing how we can go about getting permission to operate. . . the details. If there is a local ham club we'd like to know who to contact so we might meet with them. News of any DXpeditions, even to neighboring countries, is of interest. Contests, certificates, how many active hams there are, how difficult ham gear is to get, repeaters and their frequencies, sked times for really rare countries. . . you get the picture.

We've been getting reports from 55 countries so far in the *"73* International" section—I'd prefer reports from 300 or so. No, not every month, perhaps quarterly unless there is some special news we should know about. We need to know about special DX operations early since it takes about three months for information to be set in type, printed, mailed and then be delivered.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

FLORIDA QSO PARTY

Contest Periods:
1400 to 1900 UTC May 3
0001 to 0500 UTC May 4
1500 to 2300 UTC May 4

This is the 20th annual Florida QSO Party, sponsored by *Florida Skip*. All amateurs worldwide are eligible and invited to participate. All amateur bands may be used, 160 through 2 meters. All stations will separate phone and CW logs; phone and CW are separate contests. A station may be worked once on each band on each mode. Neither crossband nor crossmode contacts will count for contest credit. Florida stations may work other Florida stations, but for contest points only. Out-of-state stations may not work each other for contest credit. Contacts made on repeaters do not count for credit.

Florida stations will be divided into two classes. Class-A stations are those operating portable or mobile on emergency power and running 100 Watts or less output inside Florida but outside of their home counties. Class-B stations are all other stations operating in Florida. Entrants may be single operator or multi-operator, and this must be indicated on the summary sheet.

Each entrant agrees to be bound by the provisions of the contest announcement, the regulations of the applicable licensing authority, and decisions of the *Florida Skip* Contest Committee, which are final.

EXCHANGE:

Florida stations send RS(T) and county of operation. Others send RS(T) and U.S. state, Canadian province/territory, or country.

FREQUENCIES:

Phone—3.945, 14.279, 21.379, and 28.579.

CW—3.555, 7.055, 14.055, 21.055, and 28.055.

SCORING:

Florida stations count one point per QSO with out-of-state or other Florida stations. Multiplier is the sum of states (49 maximum), provinces/territories (12 maximum), and DX countries (27 maximum) actually worked. Note that the maximum multiplier is 88. Florida Class-A stations only: multiply final score by 1.5 to obtain total score. Others count 2 points per QSO with each Florida station. Multiplier is the number of different Florida counties worked (67 maximum). Final score is the product QSO points and the multiplier.

AWARDS:

Certificates for phone and CW to the top single-operator score in each state, province, territory, DX country, and each Florida county. Multi-operator winners will receive certificates as activity justifies. There are also 5 plaques to be awarded as follows: high single operator in Florida and out-of-state, CW and phone; and to the Florida club with the highest aggregate score. There is no minimum number of contacts to be eligible for a certificate.

ENTRIES:

Phone and CW entries are to be separated! Along with legible logs in chronological order, a summary sheet is required with each entry. Those with 200 QSOs or more must supply a dupe sheet. The summary sheet must contain claimed score, Florida county or state operated from, number of QSOs, multiplier total, station callsign, entry class, and power source for Class-A entries. The name of the Florida club for which aggregate total credit is being assigned must also be on the summary sheet. A signed declaration that rules and regulations have been observed must also be included. Sample summary and log sheets are available for an SASE from the QTH below.

At the discretion of the contest committee, stations and/or operators may be disqualified for improper reporting, excessive dupes, errors in multiplier lists, unreadable logs, obvious cheating, etc. All entries must be received on or before June 6. Mail all entries to: *Florida Skip* Contest Committee, North Florida Amateur Radio Society, PO Box 9673, Jacksonville FL 32208.

ARRL VHF/UHF SPRING SPRINTS

May 8—1296 MHz
May 17—50 MHz

Each sprint runs from 7 p.m. to 11 p.m. local time. These contests are sponsored by the ARRL; each is a separate event and are single operator only.

Retransmitting either or both stations or use of repeater frequencies is not permitted. Only recognized simplex frequencies may be used. Contest entrants may not transmit on repeaters or repeater frequencies for the purpose of soliciting contacts. Use of the national calling frequencies is also prohibited.

Stations are allowed only one transmitted signal at any given time. A transmitter used to contact one or more stations may not be used subsequently under any other callsign during the contest—except for family stations for which more than callsign is assigned to one location by FCC, DOC, etc.

EXCHANGE:

Grid-square locators (see January, 1983, *QST*, page 49); signal reports are optional.

SCORING:

Count one point per valid QSO and multiply QSO points by the

CALENDAR

May 3–4	**Florida QSO Party**
May 8	**ARRL 1296-MHz Sprint**
May 17	**ARRL 50-MHz Sprint**
May 17–18	**ARI Italian International Contest**
May 17–19	**Michigan QSO Party**
May 27–28	**CLARA Ac/Dc Mystery Contest**
May 31–Jun 1	**National 6-Meter Invitational Net Activity Day Contest**
Jun 14–15	**ARRL VHF QSO Party**
Jun 28–29	**ARRL Field Day**
Jul 1	**CARF Canada Day Contest**
Jul 12–13	**IARU Radiosport Championship**
Aug 2–3	**ARRL UHF Contest**
Aug 16–17	**New Jersey QSO Party**
Sep 13–14	**ARRL VHF QSO Party**
Oct 11–12	**Rio CW DX Party**
Nov 1–2	**ARRL Sweepstakes—CW**
Nov 15–16	**ARRL Sweepstakes—Phone**
Dec 5–7	**ARRL 160-Meter Contest**
Dec 13–14	**ARRL 10-Meter Contest**

WELCOME TO NOARS COUNTRY

K8KRG

ARRL Special Service Club

Northern Ohio Amateur Radio Society

Noars Contest Station — WB8JBM
144.55/145.15 146.10/.70 449.8/444.8
223.10/224.70

NOARS LOG

Basic Amateur RTTY Freq. "BARF" - 147.555
"1983 Field Day National Champions"
4A - 5A Battery

NEWSLETTER OF THE MONTH

One of the most consistently excellent newsletters we've seen over the past few years is the *NOARS Log*, journal of the Northern Ohio Amateur Radio Society.

NOARS is a large club with a high level of participation, and the pages of the Log chronicle the varied activities of the members in an easy-to-read style. Each issue is packed with useful information, making the Log almost a monthly reference manual!

Congratulations to Editor Bill Heitzenrater N8DSG and NOARS President George Morningstar W8ANM for their model publication.

To enter your newsletter in *73*'s Newsletter of the Month Contest, send it to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: Newsletter of the Month.

number of different grid squares worked for final score. For a valid QSO to occur, callsigns and grid-square locators must be exchanged and acknowledged. A station may be worked for credit only once per band regardless of mode. Crossband QSOs do not count.

ENTRIES:

Entries for each contest must be postmarked by June 20th. Remember, each contest is separate; use separate envelopes for each contest. Submit separate log and summary sheets for each contest entered. Logs must indicate time, callsign, and complete exchange for each valid QSO. Multipliers must be clearly marked in the log. Include dupe sheets with entries of more than 100 QSOs. Use the official entry forms, available from ARRL HQ for an SASE.

Each entrant agrees to be bound by the provisions as well as the intent of the published rules, the regulations of his or her licensing authority, and the decisions of the ARRL Awards Committee. Usual disqualification rules apply. See *QST* for any last-minute rule changes. All entries and form requests should be addressed to ARRL, 225 Main Street, Newington CT 06111.

MICHIGAN QSO PARTY
Contest Periods:
1800 UTC May 17
to 0300 UTC May 18
1100 UTC May 18
to 0200 UTC May 19

This year's QSO party will be sponsored by the Oak Park ARC. Phone and CW are combined into one contest. Michigan stations can work Michigan counties for multipliers. A station may be contacted once on each band/mode. Portable/mobiles may be counted as new contacts each time they change counties.

EXCHANGE:

RS(T), QSO number, QTH as state, Michigan county, or country.

FREQUENCIES:

Phone—1.815, 3.905, 7.280, 14.280, 21.380, and 28.580

CW—1.810, 3.540, 3.725, 7.035, 7.125, 14.035, 21.035, 21.125, 28.035, and 28.125

VHF—50.125, 145.025, and 146.52.

SCORING:

Multipliers are counted only once. Michigan stations score 1 point per phone QSO, 2 points per CW QSO, 5 points for each W8MB contact, and multiply QSO points by the total number of states, countries, and Michigan counties. KL7 and KH6 count as states; VE counts as a country. Maximum multiplier is 85.

Others take QSO points times the total number of Michigan counties. QSO points are 1 point per phone QSO, 2 points per CW QSO, and 5 points for each club station contact with W8MB. Maximum multiplier is 83.

VHF-only entries: same as above except multipliers per VHF band are added together for total multiplier. No repeater contacts are allowed.

AWARDS:

Plaques to Michigan entries are high multi-operator/single-transmitter score, high Michigan score, high Michigan (Upper Peninsula) score, high aggregate club score, high VHF-only (100 QSOs minimum), and high Michigan mobile. Certificates to high score in each Michigan county with a minimum of 50 QSOs. Out-of-state plaque and certificates for high score in each state and country.

ENTRIES:

A log and summary sheet is requested showing the scoring and other pertinent information, name and address in *block letters*, and a signed declaration that all rules and regulations have been observed. Michigan stations include club name for combined club score. Party contacts do not count toward the Michigan Achievement Award unless one fact about Michigan is communicated.

Members of the Michigan Week QSO Party Committee are not eligible for individual awards. Decisions of the Contest Committee are final. Results will be final on July 30th and will be mailed to all entries. Mailing deadline is July 1 to: Mark Shaw K8ED, 3810 Woodman, Troy MI 48084.

Michigan Achievement Award

This will be the 28th year that hams have had their own program to publicize Michigan and its products. Just as in past years, the governor will award Achievement Certificates to hams who take part in telling the world of Michigan's unlimited resources, opportunities, and advantages. Certificates are awarded on the following bases:

1. A Michigan ham submits log information and names and addresses (if possible) of 15 or more contacts made with out-of-state or DX hams in which information regarding Michigan was passed.

2. An out-of-state ham (including Canada) submits log information and names and addresses (if possible) of at least 5 Michigan hams who relate facts to him about Michigan.

3. A foreign ham (excluding residents of Canada) submits the call letters and name/address plus log information for at least one Michigan ham who has told him about Michigan.

Only QSOs made during Michigan Week, May 17–24, will be considered valid. All applications for certificates must be postmarked by July 1st and mailed to Governor James Blanchard, Lansing MI 48902, U.S.A.

ARI ITALIAN
INTERNATIONAL CONTEST
Starts: 1600 UTC May 17
Ends: 1600 UTC May 18

The object of this contest is for worldwide amateurs to contact Italian stations, including San Marino, Vatican City and SMOM. Use all bands 160 through 10 meters. Operator classes include: single operator CW, SSB or mixed modes, multi-operator single transmitter, and SWL. Multi-operator stations can use both CW and SSB.

EXCHANGE:

RS(T) plus QSO number starting with 001. Italian stations will send a two-letter province instead of the QSO number.

SCORING:

European stations count 2 points for each QSO with an Italian station. Others count 4 points per Italian QSO. The same station can be contacted on the same band once on CW and once on SSB.

Count one multiplier for every province per band. San Marino, SMOM, and Vatican City are additional multipliers. Final score is the sum of QSO points from all bands times the sum of the multipliers from all bands.

AWARDS:

A special award will be issued to the top 5 of every class of participation. A certificate will be awarded to the top scoring operators in each country and for each category. The WAIP (Worked All Italian Provinces) is issued to all amateurs for contacts with 60 different provinces. This will be issued upon a written application in the log, and a separate list of QSOs for the award. Only for contest QSOs, QSLs are not required. The cost to the WAIP award is 10 IRCs.

ENTRIES:

Logs must contain date/time in UTC, band, mode, call sent/received score and new multiplier. Use separate logs for each band. Include a summary sheet with your callsign, call of participation, QSO points and multipliers on each band, and final score. Usual declaration that rules of the contest has been followed is also required. Don't forget your full address, rig description, and comments.

Logs must be mailed within 40 days from the end of the contest to: Giorgio Beretta I2VXJ, Via Sciesa 24, 20135 Milano, Italy, or addressed to: Contest Manager, c/o ARI, Via Scarlatti 31, 20124 Milano, Italy. Any logs without a summary sheet and declared score will be used as a check log. A declared score of 5% more than the actual score means disqualification.

CLARA AC/DC
"MYSTERY" CONTEST
Starts: 1800 UTC May 27
Ends: 0800 UTC May 28

The contest is open to all YL and OM amateurs. Each CLARA station may be worked twice, once on CW and once on phone, or same mode on two different bands. All contacts must be made in accordance with operator and station license regulations. No net or list operations, no crossmode contacts, no 10- or 2-meter repeater contacts. Three unidentified "Mystery" stations will be operating during the contest.

EXCHANGE:

Name, serial number starting with 001, RS(T), QTH, and if a CLARA member.

FREQUENCIES:

Phone—3.755, 3.900, 14.160, 14.280, 21.300, 28.488, and 28.588.

CW—3.690, 7.035, 14.035, 21.035, and 28.035.

SCORING:

For the base score, CLARA members score 1 point per contact with nonmembers (whether OM or YL), 2 points per contact with CLARA members, and 3 points for each CW contact. Non-

members score 2 points for each CLARA contact, 3 points for CW contacts. All multiply the base score points by the number of Canadian provinces/territories worked for the total score. The contest manager will add 10 points to the base score of each log for every Mystery station contacted.

AWARDS:

CLARA members are eligible for the 1st place CLARA cup and certificate or the 2nd place certificate. Nonmembers will receive a plaque for 1st place, and certificates for 2nd place and 1st DX. All logs submitted are eligible for the mini-prize drawing as well.

ENTRIES:

Single log entry with logs showing date/time (GMT), band, mode, callsign worked, report and serial number sent, report and serial number received, name of operator of station worked, QTH, and points claimed. Logs must be signed and show full name, callsign and address of operator, and final score (points claimed not including mystery stations). Logs must be legible, no carbon copies, and no logs will be returned. Decisions of the contest manager will be final. Logs must be received by the contest manager before July 15th. Address entries to: Muriel Foisy VE7LQH, RR#1, Pender Island, BC, Canada V0N 2M0.

NATIONAL 6-METER INVITATIONAL NET (SIN) ACTIVITY DAY CONTEST
Starts: 1400 UTC May 31
Ends: 2400 UTC June 1

All 6-meter ops invited to enter.

EXCHANGE:

Call, SIN # and grid square.

SCORING:

SIN member QSOs count 3 points, non-SIN members count 2 points. Multiply grid squares by points received for total score.

ENTRIES AND AWARDS:

Certificates issued to three highest scores and one lowest score. Send contest logs by July 1st to Lisa Lowell, KA0NNO, POB 249, Ft. Lupton CO 80621.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

COPYING THE MAIL

The biggest kick I get out of doing the annual "FUN!" poll is reading the comments nearly everyone adds to their response forms. To call hams an opinionated lot would be to understate the situation!

Lack of space usually prohibits printing more than a handful of remarks at the end of the yearly results, so this time around I'd like to dedicate an entire column to our readers' view of ham radio.

In many ways, I find the comments more illuminating than the raw statistical data. The numbers tell part of the story, showing how many hams think one way or the other on a particular issue. But data don't express the human side of the hobby—the hams who feel stymied by a lack of leadership or those who fear for the hobby's future.

Next month we'll bring you the data. For now, let's take a look at the emotions.

Here's a representative sample of what you had to say:

This was lots of fun—KD8VU
That was the idea.

To say that I cannot operate in a particular range of the ham radio spectrum is, and shall always be, in my opinion, a blatant violation of my personal rights under the first amendment of the U.S. Constitution under the subheading of free speech. It could also constitute a violation of my "civil rights" as well—WA2RCB
Right. And not allowing me to drive my Corvette at 140 mph down the Long Island Expressway violates my rights, too. Ain't government something else?

What happened to the fun questions about gay nets or pocket protectors?—KA9NZI
The humor wears off after a few years. Sort of the same reason why I stopped reading QST.

The FCC puts fear in most people. I have never heard of a ham being afraid of another ham. It's 6:20 am here. I just talked to one of those do-gooder hams . . . he says I should be on the air making contacts, not writing a letter that will end up never being read!—KA9LNT
I'm afraid of W1AW, but only on October 31. Tell your buddy he's wrong.

Amateur radio must advertise if it wants younger people to join. Make ham radio known.
Were you thinking of placing ads in Modern Maturity *or* Casket and Sunnyside*?*

When they market a machine with the features of the Amiga, the popularity and reliability of the IBM/XT/AT, and sell it for $1,000, I'll buy it.—WB3JYF
And when they market a car with the features of a Corvette and the popularity and reliability of a Cadillac Eldorado, and sell it for $5,000, I'll drive it!

I see learning the code [as] a way to keep the CBers off the ham bands (some still get in); anyone really wanting to become a ham can study and learn the code and earn their license.—KA7PRR
I guess I'm one of those little devils who snuck in (ex-KBX-8669).

John—how about trying some questions on weak signal VHF/UHF stuff?—Anonymous
I would have, but I didn't have the energy.

I kind of resent the word amateur, but, then again, that is the only way that there can be a differential between commercial and nonprofit radio operation.—KK2W
There's nothing wrong with being an amateur, OM. An amateur is motivated by love, not mere money. A true amateur never purposely does shoddy work. Can the same be said for professionals?

I am returning to the hobby after a 30 year absence. Things have changed somewhat.—KB6HYK
Yeah, we're all a lot older.

For someone having technical interests, finding a rewarding and interesting QSO can be hard. I helped to write MCI Mail. Hope you like it. Also, contests have got to go.—KC3NG
I like MCI Mail and use it at least two or three times a week to mail manuscripts to editors. Good job. As far as contests go, let's attack 40 meters with flaming torches during SS weekend.

Plan to buy home computer soon, but not for radio use.—Anonymous
I know what you mean, computers make lousy radios. However, the old TRS-80 Model I was so badly shielded it worked fine as a transmitter.

I feel the ARRL is doing a good job in lieu of an effective FCC.—N0EON
Uh-huh. And I feel that a broken light bulb does a good job in lieu of an effective 6146B.

Contesting should be limited to certain segments of the bands.—Anonymous
Yeah, 900 GHz and up.

Don't let computers scare you. Kids will still take interest in ham radio.—KL7GID
Computers don't scare me. I make my living writing about them. It's the people selling them that make my hair (what's left of it) stand on end.

Question 50 is ghoulish and unwanted! I'm conservative and enjoy rock music. How do you categorize me?—Anonymous
Ghoulish and unwanted.

Why did you print most of the questions to this poll on the other side of [the] page. I had to flip this damn page 37 times! Bet you lost quite a few potential responders because of this.—K1DOW/4
Yeah, guess I lost all of the readers with weak arms. CW will do that to you.

Yes, I wear a pocket saver. VE program stinks. *73 Magazine* downhill without Wayne. New calls stink. ARRL detriment to amateur radio.—K3PLV
But how about an opinion?

Be sure ARRL gets a copy of your final numbers.—K4YTB
I think they have a subscription.

I think the students at Junior High School #22 should stop begging for equipment.—K7ERN
Do you know how much money the NYC Board of Education spends on ham radio? Close your eyes and you'll have a rough estimate. Instead of griping, you should send your unwanted gear to WB2JKJ or to your local school. Make an investment in our future.

I think the last two questions are slightly unfair. If I heard an emergency net in progress, I would listen first to determine if I could be of help or would hinder the operating. As a member of ARES I get plenty of opportunity to offer my "skills" for community service.—KC7NA
Slightly unfair, but FUN!, right?

Could you send results—prepublication—of this annual event?—WA2OVG
That would be cheating, Hank. How much will you pay me?

Will be interested in seeing your tabulation.—K0GP
Next month, OM

NK6K > PACKET

Harold Price NK6K
1211 Ford Ave.
Redondo Beach CA 90278

Starting with this issue, 73 is proud to add Harold Price NK6K to our growing list of specialists.

Harold has been active in the field of amateur packet radio since early 1982. Starting with home-brew hardware, software, and protocols, he switched over to the AX.25 protocol when it was first announced as a standard in October 1982. He was one half of the first on-the-air two-way contact using the AX.25 protocol. He was also part of the three-person team that developed the software used on the TAPR TNC-1.

He was part of the early packet experiments on the OSCAR-10 spacecraft. He worked on the US/Canada hardware and software team that supplied the Digital Communications Experiment for the UoSAT-OSCAR 11 spacecraft. He assisted in final launch preparations and has continued to develop new software for the orbiting spacecraft. He is project manager for the PACSAT satellite.

Harold has authored many articles on amateur packet radio, including several that were published in non-amateur magazines. He is a regular speaker at both local and national amateur gatherings, as well as at non-ham conventions and meetings for the IEEE, computer shows, and the broadcasting industry. He is active in southern California band-planning efforts and in local packet activities.

Harold is on the board of directors of TAPR and AMSAT, and serves on the ARRL Ad Hoc Digital Communications Committee. Professionally, Harold is a computer and communications consultant.—Ed.

Welcome to the new packet-radio column! Before we start, I'd like to try something, so please bear with me.

I don't always agree with Wayne Green. The ARRL has done a lot to further the development of packet radio.

If there were fewer than two sentences in the above paragraph, then you'll know that Perry Donham was less than honest when he talked me into doing this column. In fact, if this whole introduction is missing, you'll know he fudged on the additional promise that I could be irreverent!

While we're on the subject of honesty, I should say that I live in that great non-federally-funded anthropological and sociological experiment called southern California. Therefore, any warped views should be regarded as environmental and not hereditary, so don't blame my Dad N3ECV.

Next, this column is a "conducted column," not a "written" one. That means this is a participatory venture—you are requested to write to me with news, thoughts, comments, and gripes. Only write if you agree with me, though; if you want to disagree with someone, write to Wayne.

That said, let's get to it. The subject is packet radio and other high-speed digital communications techniques. As of this writing I'm a member of three bodies that should interest you if you're interested in packet radio. I'm on the board of directors of the Tucson Amateur Radio Corporation (TAPR), the board of directors of the Radio Amateur Satellite Corporation (AMSAT), and I'm a member of the ARRL Ad Hoc Digital Communications committee. That means I'm in a position to hear some interesting things about what's going on in packet, things that I'll pass on to you. It also means that I can pass your thoughts on packet to the decision makers of the organizations that are actively involved in the development of packet radio. Even if you disagree with me, I'll pass your comments on... grudgingly.

Terms

You'll find that the term "packet" is in danger of becoming a generic term for any high-speed amateur digital communications technique. It is actually only a subset of the possibilities. Packet is a technique of breaking information down into small pieces, appropriately called "packets." The act of passing these pieces around in interesting ways is called "packet switching." There are other ways to pass information around in digital form, but few if any have been implemented on amateur radio yet. Hopefully, the next few years will see digital voice, digital video, and other high-speed digital forms of communications come into use. This column will "limit" itself to digital communications, excluding CW, RTTY, and AMTOR, as these three modes are adequately covered elsewhere.

Packet Introduction

I don't have much room left over this month to give a full introduction to packet radio. Besides, that could be a little dull, so we'll do the training a little bit each month. In case you've never heard about packet before, here's a real short introduction:

Packet is a method of sending information over amateur radio, just as spark, CW, AM, SSB, FM, RTTY, AMTOR, SSTV, and FSTV have done down through the years, but with two major differences. Packet provides for "perfect" information transfer, and it permits multiple simultaneous contacts on the same frequency. It is "perfect" because packet uses computers and a complex method to check each piece of information to see if it was received correctly. Packet procedures ensure that a packet is retransmitted until it is received correctly. Packet can share a frequency because information from any one station is broken into small pieces. These pieces can then be mixed in with pieces from other stations on a single frequency. Because each packet is tagged with the callsigns of the sending and receiving stations, each station can keep track of which packets are for it.

The device used to "do" packet radio is called a Terminal Node Controller (TNC). This is a small interface box that goes between your radio and your terminal or computer. The microprocessor inside the TNC takes care of following all the procedures necessary to exchange data with other stations. To learn more about packet, check back in your stacks of magazines for, or borrow from a friend, the following:

Price, H., "What's This Racket About Packet" and "A Closer Look at Packet Radio," *QST*, July and August, 1985.

Johnson, L., "Join the Packet Radio Revolution," *73*, September and October, 1983, and January, 1984.

These articles contain pointers to other information sources on packet. Most larger radio stores will have a TNC on display or even operating on the air. The most common frequency in use for packet radio in North America is 145.01 MHz. We'll do a little more on packet introductory material here next month.

Packet History

Following is a capsule history of some of the aspects of packet-radio development. I have previously placed an earlier version of this history on public BBS systems, so you may have seen some of this before. But for newcomers to packet, here is the answer to the question, "How long has amateur packet radio been around?"

•September 1978: Non-baudot digital transmissions made legal in Canada. Digital experimentation begins.

•January 1979: Vancouver Amateur Digital Communications Group (VADCG) formed. This group produced the VADCG TNC, some of which are still in use today.

•Summer 1979: Work begins in Ottawa and Montreal. Total North American digital users = less than 30.

•March 1980: ASCII data legalized in the United States. Canadian missionaries armed with VADCG TNCs and software cross the border.

•December 1980: First United States digipeater goes on the air in San Francisco. It used home-brew hardware and software based on the VADCG protocol (now called V1).

•1981: First great packet diaspora begins. VADCG distributes PC boards. Home-brew systems are developed. Most areas standardize on 1200-baud Bell 202 modems, VADCG-compatible hardware, and 2-meter FM. Locally maintained software versions in San Francisco, Washington DC, Vancouver, and elsewhere begin to diverge.

•October 1982: AMSAT and AMRAD host another in a series of meetings to solve the divergence problem by developing a protocol standard. Other major goals include the desire to support more than the 32, 64, or 128 users allowed by then-current V1 implementations. The AX.25 standard is born. Total North American digital users = less than 200.

•January 1983: After several months of design and testing, the Tucson Amateur Packet Radio (TAPR) group produces 170 assembled and tested beta-test TNCs.

•October 1983: The kit version

of the TAPR TNC (now called TNC-1) is tested by 19 users.

•December 1983: 200 TNC-1 kits are shipped. In the meantime, more VADCG boards are assembled. GLB takes out its first ad in *QST* for an assembled and tested unit. Total TNCs = about 650.

•1984: TAPR begins to ship TNC-1 kits in bulk. They ship an average of 120 TNCs per month for the next 15 months. AEA announces an assembled TAPR TNC-1 clone at the Dayton Hamvention. Packet hits the big time when Lyle Johnson WA7GXD wins the Dayton Hamvention Technical Excellence Award for the TAPR TNC. He accepts on behalf of packet radio and TAPR. AEA legitimizes packet by placing the first full-page ads for packet equipment in the big ham magazines. At the end of 1984 there are more than 2500 TNCs.

•1985: Heath announces the HD-4040 TNC-1 clone kit, begins shipping in April, and sells out the first 500 in three weeks. Kantronics announces the "Packet Communicator." TAPR announces TNC-2. GLB announces PK1L. AEA announces PK-64 and PK-80. For a time in August, most of the packet industry is "sold out," with demand far exceeding production. Bulletin board systems running software designed by W0RLI begin to proliferate. "RLI" systems allow for the automatic exchange of messages between them. Messages, routed by the BBS systems, crisscross North America on a combination of HF, VHF, and UHF frequencies. Ties between the National Traffic System (NTS) and packet networks become more common. There are at least 10,000 TNCs in the field, worldwide.

•January 1986: More TNCs and TNC add-on products are announced. AEA announces an HF modem that can be added to any TNC. When an amateur group in Ester, Alaska, produces a VHF/HF mode switch for TNC-1 and TNC-2 style modems, they give their street name as "AX.25 Communications Trail." It is predicted that more than 14,000 TNCs will be in the field by March. The number of amateurs working on improvements to existing packet networks and developing new directions for the future is also increasing. A group in Hamilton, Ontario, is making an IBM PC plug-in board available. A Texas group is working on a network linking system, as is a group in Florida. TAPR is working on networking hardware and software. Networking software from New Jersey will be available soon.

1986 will see the launch of two satellites with packet radio facilities on board, Japan's JAS-1 and the international AMSAT Phase III-C. The UK's UoSat-OSCAR 11 satellite, with its American-Canadian digital store-and-forward message system, has already been tested as an international information transfer device and will see greater use in 1986. This column solicits information on these and other items for discussion in the coming months.

Prove It, Packet

In closing, I'd like to answer a letter that was printed in the December, 1985, issue of *73*, page 69, under the headline, "Prove It, Packet." It seems that the letter writer went to a hamfest where an over-zealous speaker claimed that packet would replace CW/RTTY/AMTOR. I agree with the writer when he says this won't happen. The only modulation mode that ever disappeared in amateur radio was spark gap, and you can still get a demonstration of that at many hamfests.

Thereafter, the writer and I part ways. First, he refused to believe another packet proponent at the hamfest who said packet interface units would cost less than $200 by the end of the year. Through the magic of publishing lead time, the very same issue of *73* contained several ads for packet gear that carried a list price of between $209 and $219, and retailed for just below $200. GLB announced a unit that you can almost fit in a shirt pocket, and AEA had one that does CW/RTTY/AMTOR/ASCII as well as packet for the same price.

Next, the writer doubted that packet is error-free. Well, he *can* argue the point, but Andrew S. Tanenbaum, in *Computer Networks* (Prentice-Hall, 1981), says about the same error-detection scheme used by the AX.25 packet protocol: "[it] catches all single- and double-bit errors, all errors with an odd number of bits, all burst errors of length 16 or less, 99.997% of 17-bit error bursts, and 99.998% of 18-bit and longer bursts."

Less easy-to-quantify factors in the protocol, having to do with the callsign fields, control fields, and flags, comprise a large portion of the 0.002 percent of errors that slip by. You must also compute the probability that 17 or more bits will be bad in any given packet. Then multiply all the probabilities together. The chances are less than one in a million that you will get an undetected error. As a rough guess, you would have to send 128 million characters before you stood a small chance of seeing an undetected error. Since even Ivory Soap is only 99.44 percent pure, this is close enough to error-free for most people. The reason packet data arrives error-free is that packets with detected errors are retransmitted until they are received correctly.

Packet bandwidth is discussed, but that's a subject for an entire column. The writer then mentions the transmitter keying rate. Actually, packet is efficient in terms of toggles per information passed. Packet will switch once per 80 or so characters passed in a conversational mode, or once per 400 characters when moving large files. AMTOR switches once every three characters. Full break-in CW, depending on the settings and operator habits, can switch once per word, or once per character.

Finally, the writer asks why, if only 200 Watts eirp are required to access OSCAR 10, do you always see photos of 25-foot dishes or stacked 12 over 12 arrays. Because the guys with the metal in the air like to take photos of it, that's why. Those of us with just the 10-dB-gain yagi never get around to taking the pics. I put 100 Watts into 3 dB of cable loss and a poorly made N connector, then into an 11-dBi-gain antenna. I then crank the power back until I'm no louder than the beacon.

Aside from the OSCAR 10 comment, "Prove It, Packet" is a victim of rapidly advancing technology. We've come a long way in a short time, and we've hardly gotten started. Because things have a habit of changing very rapidly, to help you keep things straight I'll include the date that I finished each column somewhere in the column. This one, for example, is 2/24/86.

Please help make this column worth the space it's taking by sending in your questions and comments. I can also be reached on CompuServe at 71635,1174, and on packet by NK6K @ KD6SQ. Next month, more stuff like this, only different.

RTTY LOOP

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Oh boy, if only you could see this! On my desk is a stack of letters from you all. Some of them have received a response in the mail, some have not, but none of them have yet reached print. So, blessed by the wonders of my word processor, which has the ability to move whole paragraphs at the touch of a single key, let's mush through this stack together.

CoCo

I hope that Lloyd Chapman W8WHA of Toledo, Ohio, is enjoying the new CoCo keyboard he got after the tip in this column. It should slip right into the CoCo II, and there are several programs around to help use the "extra" keys. One was mentioned here a few months back.

William E. Mangor VE3BOQ of Morrisburg, Ontario, relates that the quick CoCo RTTY output program in the March, 1985, "RTTY Loop" column works fine, with one problem. The CoCo printer routine assumes that the printer adds a line feed after each carriage return, whereas the teleprinter requires that a line feed be sent. He wants to know how to do this using software. Well, the "down arrow" key on the CoCo will send a line feed, but that will only help a tad. Best bet would be to put in a machine-language filter to add a line-feed character after each carriage return. I would rather not fill these columns with listings unless there is some demand for it. So let me know, and I'll be glad to print a suggestion if a bunch of you need it.

Jay Sarajian WB3BKW in Feasterville, Pennsylvania, enjoyed the patch for Clay Abrams' NEWRTYCW program published here a few months ago. He said he had to save it as "PATCH/BAS" though, instead of "PATCH.BAS"

as titled here. I don't know why, Jay, as I normally use the period rather than the slash routinely for CoCo extensions. Not only that, but (CoCo'ers take note) you can also preface the drive number (*i.e.* 1:PATCH.BAS) rather than suffix it (PATCH.BAS:1). At least you can do this with standard Radio Shack DOS version 1.0 or 1.1. If you are using ADOS it should work as well, but if you are using JDOS all bets are off, as many of the pointers and routines have been customized. Would be interested to hear the follow-up, Jay.

Jim Leischner KA9RGJ in Cisco, Illinois, is another CoCo user who is hard at work to put his computer onto RTTY. I hope the material I sent you helped, Jim. I think you will find that the CoCo is a flexible computer that will be able to do just what you want.

Same thoughts go out to Bob Hartley K2QJ of Kendall Park, New Jersey, who is also looking to put his CoCo onto RTTY. As I have indicated, Bob, the Abrams program is the only one I have seen, but that doesn't mean that there won't be something else soon. Just keep reading, right here!

Teleprinters

Carl Anderson WA6CMT of Santa Ana, California, counts himself as one of the "silent" readership who has flirted with the RTTY bug for a long time, and now hopes to interconnect a Model 32 and/or Model 33 Teletype® with his ham gear. Well, Carl, I hope that the material presented here last month helped your efforts. Let me know how it goes!

Using an Info-Tech interface, Joe Kovarik, Jr. KD9G in La Grange Park, Illinois, is looking to hook up his Model 33 as well. Again, I hope the information from last month helps, Joe. With a Model 15 on the Murray/Baudot port and a Model 33 on the ASCII port of that interface you'll have quite a station!

Not everybody is working on Model 33s, though. Mark Hines KA8TNT of Ludlow Falls, Ohio, acquired a receive-only Model 28 and would like to interface that machine on RTTY. Assuming you have loop connections, Mark, this should be trivial. Hook into the TTY loop, send it some five-level goodies, and see what prints.

C-64/VIC-20

Interest in alternative means of interfacing the Commodore 64 computer remains high, as evidenced by the note received from George Tubb W5HI in Los Alamos, New Mexico. George is looking for, among other things, interfacing other than that provided by the likes of Kantronics, MFJ, AEA, Microlog, and others mentioned here in the past. Hmm. . . sounds like a tall order to me! I print what I get, George. I know I've said this before, but if I have not written about an item, it is not because of bias, it's because I have no information to write about. Manufacturers, are you listening? Stay tuned for Chapter Two, George!

George "Keoki" Susterich KH6DXO in Hanapepe, Hawaii, is also looking to put his C-64 onto RTTY. I have sent him the ever-growing list of "RTTY Loop" reprints available, and hope that the information printed here lately helps him connect one of the teleprinters he has to the C-64 for use as a system printer.

A VIC-20 user, Michael V. Hoffman N7GLO in Eugene, Oregon, is busy building the one-chip demodulator we talked about here a few months ago. He is trying to look into Murray-to-ASCII code conversion himself. Well, Michael, there are many schemes in use to convert five level to eight level and back again, and I think that a brief look through some back issues of *73* and other magazines may turn up just what you're looking for. There are certainly a number of commercial schemes, many of which I have touched upon here, and one of them may do as well.

Michael also asked a rather fundamental question that I have not covered here in some time, so I'll throw it in now for good measure. He said that in "thinking about AFSK and SSB rigs, . . . it seems to me that what you get from AFSK modulation of SSB is the same as you get with FSK. Can you tell them apart?" No, you can't, Michael, and that is just the point. After all, if you sent one pure tone through a SSB transmitter, what you should get, assuming that the carrier is well suppressed and there are no harmonics, is one pure rf signal, offset either above or below the suppressed carrier by the absolute value of the frequency of the audio tone used to generate it. Two tones, two rf frequencies—and if you shift one tone, you get an rf signal that shifts in step and magnitude with the audio used. Now, remember this, though—the "standard" FSK convention is low space, high mark; whereas the "standard" AFSK convention is just the opposite. So if you are using an AFSK signal to generate FSK on an SSB transmitter, use *lower sideband* so that the relationship of mark and space is reversed. If this is still not clear, let me know, and I will print a few diagrams to try to straighten this whole thing out.

Apple //

Hanspeter Nafzger HB9AQZ, a Swiss amateur who says he gets hold of a copy of *73* during his extensive traveling as part of an airline crew, is having problems putting a package onto RTTY, and wonders if any of us could help. The software in question is the Radcom Plus interface and software for the Apple, and his biggest problem appears to be that when copying OSCAR-10 telemetry data, which does not use unshift-on-space, he sees rows of letters instead of figures. He is curious if anyone has experience with this software, and might have a patch or solution. If so, drop me a line here, and I will publish the answer for Hanspeter and the rest of us, too.

My understanding is that the Apple interfaces via TTL levels. So the one-chip receive circuit from July, 1985, should interface without too much problem. Arnold Bucksbaum W0WGE of Cedar Rapids, Iowa, wants to work on that circuit for his Apple. TTL is TTL, Arnold, and the 2211 scheme should hook right up. Hope to hear from you about your success.

Miscellaneous Mishegas

Richard Keusink K7VPL in Brookings, Oregon, has the distinction of having his letter lost on my desk for quite a while. Anyway, Richard is another ham having operating hitches with his AEA CP-1. It would appear that the problems being mentioned, such as the inability to load another's call without leaving the T-R mode, are just designed into the CP-1. Looks like you will have to wait for the CP-2 (hint, hint—QSL AEA?).

Richard is also looking for press signals on the HF bands. While there have been other books on the market, the Klingenfuss books mentioned here remain the most complete one seen. Complete to the tune of overkill, in fact! I don't know if I can publish spotted frequencies here, but if my editor would let me, I would be glad to pass along interesting locations on the HF spectrum. [Spot at will, Marc!—*ed.*]

Hope all this helps, Richard, and I'll pass along whatever else I get when I know more. (Boy, I say that a lot!)

Peter Schulz in Dorval, Quebec, notes that hams interested in putting a Timex/Sinclair ZX-81 may be able to use a program he knows as the NARP program, and corresponding interface. He knows no details about this combination, do any of you? Let me know, and I will print the information here for all the T/S users to benefit.

Peter is also interested in putting a TRS-80 Model 100 onto RTTY. Sorry, but I draw a blank on that one, Pete. Again, if anyone is using a Model 100, 200, or 600, let me know, and I will help to let the gang know.

Radio facsimile transmission is not that far afield from RTTY, and the WEFAX routines mentioned here a while back have whetted a few appetites. Brad Slocum in Sunnyvale, California, is very interested in receiving this type of information via computer. Well, Brad, I know that the WEFAX routine mentioned, which was written for the CoCo, uses features indigenous to that machine. I don't know of a version that runs on IBM PC type computers. If you have a CompuServe account, you might check on the CoCo SIG (GO COCO) for the WEFAX program and related data.

Ditto to David Woolweaver K5RAV, DDS, MSD of Harlingen, Texas. David is interested in receiving WEFAX with a TRS-80 Model 4. Sorry, but I have seen nothing for that computer either for WEFAX reception. The abilities of the 6809-based CoCo really do shine in that regard.

Just what is an obsolete computer? Fred Jacob W6WBT of Davis, California, is playing with the Heathkit ET-3400 computer trainer, a 6800-based single-board computer, and wants to play with RTTY on that! Well, Fred, a few years ago I printed the source listing for both receive and transmit for the 6800 that should be easy to use on the ET-3400. They are part of the "reprint series" information that I am sending him; you can get a listing, too, for a self-addressed, stamped envelope sent to me at the above address.

Roger Wells N4AHA in Lexington, Kentucky, is interested in connecting a Heath H-89 computer to a Kantronics UTU interface. As far as I know, Roger, any terminal program should do fine, and

there are many available in the public domain. If there is a local computer BBS, I am fairly sure that a terminal program will be living there. Ask around, and don't forget the folks at your local Heath store and ham clubs. Hopefully you will be able to find a serviceable program, *gratis*, without too much trouble.

Want to get some idea of the readership of *73* and this column? Just look at where some of these letters came from: every corner of the world, it seems! I never cease to be amazed at what our buddies are doing with digital communications, and I will try to share whatever I know with you all. Let me hear from you; the letter box is looking very empty about now! As always, if you would like a reply, enclose a self-addressed, stamped envelope. CompuServe subscribers can reach me there, usually on EasyPlex, via my ppn—75036,2501. Or, if you feel lazy, just kick up your feet, and wait for the next issue of *73* to see what's in the next edition of "RTTY Loop."

ABOVE AND BEYOND

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Tired of sitting around the shack waiting for the band to open? Looking for more of a challenge than just picking off grid squares with your long-boom antenna and kilowatt amplifier? Need something to put the "zip" back into VHF operation?

Have I got a remedy for you! It's time to shake the dust off your feet and head for the hills—or lakes, mountains, beaches, even the local skyscraper—and go portable. Instead of waiting for the tropo duct to open to you, go chase it down for a change. If you're still waiting to work someone from that rare grid square, why not put it on the air yourself, and make a lot of other grid chasers happy! If you're tired of fighting the "big boys" with their super stations during contests, put something together on your own and give 'em a run for their money.

The Joys of Portable

You haven't lived until you've spent an entire weekend simultaneously working sporadic-E on 6 meters while swatting mosquitos, or latching into an enormous 2-meter opening while in a storm. Or perhaps you'd enjoy the simple pleasures of watching the wildlife devour your coax, as I did.

Whatever your VHF interest, there's a way to pursue it in a portable fashion. And there's certainly no shortage of equipment around to make do with, either! Throw some stuff in a backpack, bring some food and drink, and head for the hills. Somehow the effort required to go to an out-of-the-way location and work some DX makes the contact all that much more satisfying, and you might get more exercise than you've had in a long time. All it takes is the right equipment for the job and your desire to have fun. (Note the word *fun*: interpretations of fun will vary wildly depending on how kinky you are.)

The Contest Season

As you read this, the trees are bursting forth with leaves, and temperatures are slowly rising, so the weather will be on your side soon. How convenient that there are four major contests to choose from in each of the months from June to September.

First the ARRL June VHF QSO Party comes your way. About the time you start to recover from this, the July *CQ* Worldwide VHF WPX Contest shows up. Assuming you made it so far, you can dive into the the ARRL August UHF Contest. Finally, if you're still alive, the ARRL September VHF QSO Party wraps things up. Four good contests spaced just far enough apart to make you a committed portable VHFer for life (...or to have you committed for life!).

What do you need to go portable...well, how high is up? There are those who choose to carry a simple monoband battery-operated transceiver up a nearby hill for some casual operating, using a simple quagi beam. And then there are those who practically create a self-contained mobile communications support vehicle that rivals anything the military's got to operate multiband QRO stations, using enormous antenna arrays and sophisticated transceiving equipment. It all depends on how badly you've been bitten by the bug.

I've personally been involved with several portable operations, ranging from backpacking 10-Watt stations and single yagis up a mountain to operating from several camper/trailers with generator power, in temperatures ranging from 85 plus degrees all the way down to 30 degrees and below. I've been eaten alive by black flies and drenched in a downpour, nearly blown off a tower, and had masts fall on me in high winds! On the other hand, I've also seen some spectacular views of the night sky and had plenty of time to sit alone in the dark on a hilltop comtemplating nature (and my navel, too!).

If you've ever scampered up a tall building and drove repeater owners crazy kerchunking machines miles away, then you've probably got the bug and there's no stopping it. In fact, many people find FM portable operation to be eminently satisfying, and rare is the time when a ham doesn't throw an HT into a backpack or in with camping gear. FM portable is very popular in Japan and Eastern Europe as well. In fact, these folks may have refined it to an art form. One of the entries I saw from the *CQ* VHF WPX this past year was from a JA who used a Kenwood TR-50 (1 Watt, 1260 MHz FM portable) to work over 30 stations in the 23-cm band during the contest! We're still trying to get people up on 23-cm here, and he's busy firing off QSOs like there's no tomorrow.

Other entries received from Europe indicate a strong preference for this mode, with many Romanian logs indicating the use of home-brew 2-, 3-, and 5-Watt rigs to make contacts on 144 MHz FM, as did logs from Hungary. You see, FM simplex is still a novelty over there (and with all those countries to choose from and prefixes to work it's no surprise, really) so the amateurs turn out in force with their handie-talkies.

If you want to work something more exotic, then weak-signal work is the logical choice. Usually this means SSB or CW operations, and again the Europeans are heavily into it *a la* QRD.

Apparently, the Yaesu FT-290 is very popular in many countries for this type of endeavor, and for a time it was also available here as well. For some unknown reason, Yaesu has seen fit to pull it off the market, leaving us with no currently available portable 2m SSB/CW/FM equipment for the band. A companion unit for 6 meters also bit the dust, but the 432-MHz version still lives on until stock runs out or Yaesu cans it as well. All of these radios featured 1–2 Watts output from a self-contained battery-powered package with 12 memories, dual VFO's and a nice LCD to save power.

The FT-290 is particularly nice since its power level can be dropped into the milliwatt range. This would then allow the use of outboard transverters for 432, 1296, and even 50 MHz, giving you a very flexible station with four antennas and a small battery pack for the transverters—one which could be easily backpacked to a nearby hill. My advice would be to grab one if you see it at a flea market, as there isn't any other product that will do the job nicely.

You may also come across one of the time-honored ICOM IC-502/202/402 series radios. These were made for many years by ICOM and offered the user somewhat lower sophistication than the FT series, but developed 3 Watts PEP from a self-contained battery pack on SSB, CW, and sometimes FM across the 50-MHz and 432-MHz segments, and the radios had built-in collapsible whips (not very useful when working horizontally polarized stations, but a start, anyway). There are still plenty of them around and still plenty of hams using them for lightweight portable mountaintop stations. If you think you'd like a simple setup, the ICOMs are the way to go. You can always add an outboard amplifier as needed to boost the signal, and one of these and a 10-Watt "brick" will run for hours from a small storage battery.

Other than these, the selection of portable non-FM equipment has pretty much dried up. ICOM still makes the IC-505 for 50 MHz, which is a unique 3/10-Watt portable for SSB/CW/FM, using either a built-in battery pack on low power or external source on high power. For 144-MHz SSB nuts, Santec makes the LS-202 handie-talkie with SSB and FM modes built in, running 1.5 Watts output. Now *there's* a good ques-

tion: Why aren't Japanese making multimode handie-talkies? They would sure sell like hotcakes over here! How about it, guys?

Power

The next step is to get a small generator or battery and use a mobile multimode radio, preferably one with 10 Watts of power; 25-Watt types can be used if the power can be reduced to save battery life. With a generator, it doesn't matter. I've used a Kenwood TR-9000 for some time with outboard transverters for 432 and 1296 MHz to go portable on three bands with 10 Watts. A small motorcycle battery will do the trick for a moderate amount of operating. A better idea is to disconnect the final amplifier and run the TR-9000 barefoot and to throttle back on the output of the MMT transverters, as we did at Slide Mountain last year. With a good yagi, 2–3 Watts output will get you a long way. Being able to adjust the output of SSB or CW allows the ability to go to full power to make that weak contact, and to throttle back for the close-in stuff.

The whole arrangement shouldn't weigh more than 20–30 pounds, excepting your support equipment such as tent, food, clothing, lights, and so on. We overdid it for our first trip but when I do it again (and I surely will) the weight will be optimized. After all, there's no sense in bringing such things as a wattmeter if the problems it indicates can't be repaired anyway.

About the Antennas

As you go higher in frequency, remember: a given gain figure requires less metal. It's as simple as that. You can employ a lightweight PVC pipe as masting, or superlight aluminum mast sections, predrilled to slip together easily. We opted for surplus army masting in five-foot sections that were swaged, and locked together with long #8 screws. A single yagi for each band will suffice for the small portable station, and there are some beauties to choose from. One of my personal favorites is the F9FT 21-element yagi for 432 MHz. This antenna easily breaks down into four sections and can be assembled with a spintight (8mm) or wrench. It's extremely light, weighing in at about four pounds. And it's durable, using a dipole-driven element and secure through-the-boom element construction.

F9FT also makes small high-gain yagis for 1296 as well, but these need to be mounted at the top of a metal mast, as the diameter of the mast is a significant part of the wavelength in use. Of course, a PVC mast eliminates this problem. As for the lower frequencies, Cushcraft antennas are time-honored choices for mountaintopping, especially the 11-element and older 7-element versions. KLM makes nice yagis with 4, 8, and 11 elements for 144 MHz, as well as 7- and 14-element versions for 220. On 50 MHz, both companies have usable lightweight yagis around 9–10 pounds. I'm not too familiar with the F9FT 2-meter antennas, but the CueDee from Sweden also fits the lightweight requirement nicely.

The decision you make will largely depend on weight. If you've picked a good location near population centers and run a small amount of power—say, 10 or so Watts—then 7–11 elements on 144 and 220 will do the trick; 19–21 elements will make things happen on 432, and 19–23 elements will do on 1296. Keeping the elements to a minimum will reduce gain as well as size and weight, and will allow more antennas for other bands. One operation I participated in was from a fire tower in western New Jersey.

We ran 10 Watts on 144 and 432 MHz using a TR-9000 and Echo 70, respectively, feeding 11 elements on 2 meters and 16 elements on 70 cm (both KLM beams). This mast was a 20-foot slip-up, and everything was run from battery power in the 4WD truck we drove to the site. Had we brought a generator, we chould have run 10 times as much power, but we were limited to the truck battery. I'll tell you, the signal reports we got were amazing. Many multi-ops thought we were running kW stations! Of course, being at 1500 feet, 1200 feet above the average terrain, makes the difference.

As you might have expected, we got rained out halfway through the festivities, but still racked up some good Q totals with our simple equipment. There are plenty of mobile multimodes that lend themselves to this application, and many have the variable power output option, such as the ICOM 290 and 490. If you can throw a generator in the truck or car, then 100-Watt solid-state amplifiers will make will make the job somewhat easier for you.

Last but not least are the stations running large home-brew transmitters and receivers, or employing base-station multimode radios driving high-power tube amplifiers. A large number of contest portable stations in the United States operate in this fashion, and several hams have built entire kW stations for each band right into their truck or camper. One good example is Wayne Overbeck N6NB, of San Clemente, Calif., who has been a VHF nut for years and will travel thousands of miles to get on a hilltop and hand out a section or grid square. Wayne's small imported truck looks innocent enough from the outside, but the inside is loaded with sophisticated radios and amplifiers for 6, 2, 220, 432, and 1296. The Pack Rats (Mt. Airy VHF Radio Club) of Pennsylvania are noted for their well-equipped mobile stations which travel to as many as four or five grid squares during a contest to get on 1296, 2304, and higher. And of course the renowned W2SZ/1 group literally takes over Mt. Greylock each June and September for the ARRL QSO Parties, setting up stations into the 34-GHz and higher range.

So, there's no shortage of ideas when it comes to going portable. Want to try something really different? Go the the seashore instead of the mountains. You'll probably hook into a good tropo duct (especially in late July, August, and September) and work some unusual DX. This is becoming a favorite mode of contesters on the Eastern Seaboard of the United States. In fact, our group, SCORE, will more than likely make a stab at some sort of seaside portable operation for the ARRL June Contest, as there are plenty of grids that lie along the coast that could be activated. Best of all, they are all accessible by car or truck. And if you want to get R&R, it's off to the beach for a dip and maybe some sun. After all, all work and no play....

Remember also that portable operation is a big change for some hams who live in apartments or condominiums with restrictive antenna situations. There are plenty who break from "cabin fever" in January and head to the hilltops to run the January VHF Sweepstakes from their car with a multimode. Still others live in areas with high atmospheric or manmade noise levels, not to mention CATVI problems. I can relate to the latter, as our local system operator is pretty slow to fix leaks in the system on 2 meters and 220 MHz.

Unfortunately, the ARRL contests really don't give the small portable operator an incentive to make a serious run of it. This is a problem that really ought to be looked into, as it is somewhat ridiculous for a single operator with 10 Watts on 6 and 2 to be put in the same class with a high-powered multiband station on another hilltop—kind of like running the 100-yard dash against a Ferrari. On the other hand, the *CQ* VHF WPX does offer awards classes for the small guy, with QRP entries in the Single Operator, Single Band and Single Operator, Multiband categories. There is also a separate category for portable operation. Now the hilltops with their FT-290s are butting heads with each other, not some kW staton with multiple yagis.

Based on the returned logs, these classes are proving to be very popular. The U.S. winner in the portable category ran his jeep up a ravine in Nevada and nearly got in a washout, but still managed to make many contacts on 6 and 2 meters. This was also a popular class in Romania and Hungary. In fact, the top overall score in the world—F6KAW/P, with 1347 QSOs and 158 prefixes—was made by a bunch of guys running a pair of stacked F9FT beams on 144 MHz with 300 Watts of power. Imagine that—and they worked 85 grid squares in one weekend. If that isn't a good enough reason to try some portable operation, then I can't think of any others.

From the Mailbag

Ted Reinke KA7MNZ writes in with a queston about OSCAR operation that has been raised before. It pertains to operating full duplex with a single HF radio, which is of course not possible unless the radio is heavily modified. You'll still have to use two separate radios—one on 145 MHz and another on 435 MHz—to be able to hear your own signal back off the satellite. However, the setup need not be expensive if you go this route. All you need is a 10- or 25-Watt signal source and amplifier on 435, while a simple receiving converter into an HF radio or receiver will allow monitoring of the downlink. There are plenty of manufacturers of this type of con-

verter that advertise in this magazine.

Ten-Tec of Sieverville, Tennesse, makes an interesting unit called the 2510 OSCAR converter. Hooked up to your HF radio, it'll generate a 10-Watt signal on 435 MHz and listen at the appropriate downlink frequency on 145 MHz, using a dual-vfo system. Although not a duplex system, it saves the time spent looking for your downlink echo. All you need do is to locate the desired signal you'd like to work on 145-MHz SSB or CW and just start transmitting. The 435 uplink frequency will automatically be set.

Another question Ted raised is the use of a single twist antenna for both SSB and CW. It works fine, Ted! Several stations in my area have one antenna on both FM operation and weak-signal work. Of course, you'll have to use a noninductive mast, such as fiberglass or PVC, but you will certainly find the results well worth it. Add an elevation rotor and you can now listen to the downlink on 145 MHz. Add another twist for 435 and you'll work the uplink looking for your downlink on 145 MHz. Add another twist for 435 and you'll work the uplink, as well as weak-signal and FM stations on 430–440 MHz. A twist antenna isn't as good as an optimized long-boom yagi for either band, but it is an acceptable compromise. Just make sure that it is rated for the full frequency coverage of the desired bands. Both KLM and Cushcraft here in the U.S. make excellent twist antennas for this purpose.

Quite often you'll find the twist makes a difference on weak-signal work, since polarization of signals can shift over long distances and the twist overcomes some signal fading effects due to this phenomenon. I used one of these for some time locked into the RHC (right-hand circular) polarization mode, and I enjoyed many long-haul contacts on both SSB and CW, as well as simplex FM work.

Jan Kok WA4NZL writes from Charlotte, N.C., to inquire as to the availability of the Texas Instruments Dual-Gate GaAsFET mentioned in the December, 1985, column. Jan, I suggest you contact Kent Braitan WA5VJB through the *220 Notes* newsletter for more information. The device number is TI-S3030 and is very new to the market. The address for *220 Notes* is 308 Eastgate Circle, New Lenox IL 60451.

Let's hear from you! If you're into portable operation, send along some photos of your station and antennas, as well as any interesting stories. I'll provide more details of upcoming contests so you can plan ahead and get thee to a hilltop...See you "Above and Beyond!"

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards or odd-sized scraps of paper. Please type or print your request (neatly!, double-spaced, on an 8-1/2 x 11 sheet of paper and use upper- and lower-case letters where appropriate). Also, please make a 1 look like a 1 not an l—which could be an el or an eye, and so on. Hard as it may be to believe, we are not familiar with every piece of equipment ever manufactured on Earth! Thanks for your cooperation.

I need an owner's manual and schematic for the Tennelec Memoryscan–MS–2. I will pay for copies or will copy and return originals.

Terence J. Weil
1509 Victoria Street
Berkeley IL 60163

I'm looking for the following NAVSHIPS manuals: 93788 Vol. 2/3, 92175, 93241, 93210, and 91713

Charles T. Huth WB8NLM
229 Melmore Street
Tiffin OH 44883

Need one each 6SK7 and 6SG7 tubes. Will trade other items for same.

Gerald Samkofsky N4ZB
1420 Mount Vernon Drive
Holiday FL 33590

I have an R-508/ARC Command Receiver and badly need a schematic diagram of it. If you could supply one I would be glad to pay for it.

Martin Prescott
69 North Shore Road
Derry NH 03038

Wanted: Operation and/or service manuals for the Cushman CE-2B service monitor. I will pay any reasonable costs involved.

Dave Land KD5FX
2515 Bonnie
Ponca City OK 74601

I need any information on a computer unit labelled "C3 Data System" and "Interdata." The processing part has the identification number 7/16Jwin. The frequency meter is by Eldorado Electrodata ACL model FRO-212-2, also known as model number 1660-4, pulse generator Rutherford Elect. Co. model B7F. All items bought at a U.S. Army sale in Europe. All reasonable expenses paid.

Crispino Messina
Via di Porto, 10
50058 Signa FI, Italy

I am compiling a list of international amateur radio nets (DX or special interest), calling frequencies, gentlemen's agreements, and so on. Details appreciated.

Ash Nallawalla ZL4LM/VK3CIT
PO Box 539
Werribee VIC 3030, Australia

I have inherited a 6-element tribander manufactured by TET. The instruction manual that accompanied the antenna is for model TE-3F36DX. Unfortunately, the dimensions in the documentation do not match the aluminum in my garage. Calls to TET and their distributor have not shed any light on the situation.

Does anyone have any data on 6-element TET tribanders?

Bernard M. Spiegel KJ4KR
ex N4MJC
PO Box 161192
Memphis TN 38186

TEST EQUIPMENT

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HP 608D SIGNAL GENERATOR, 10 MHZ TO 420 MHZ AM, CW OR PULSE OUTPUT, 400/1000 HZ MODULATION OMV TO 5V INTO 50 OHMS, CALIBRATED ATTENUATOR $295.00
TS-510A/U SIGNAL GENERATOR, 10 MHZ TO 420 MHZ MIL/SPEC MILITARY VERSION, SAME AS HP608D $295.00
HP614A SIGNAL GENERATOR, 900 MHZ TO 2100 MHZ, INTERNAL OR EXTERNAL PULSE OR FM MODULATION, 0.5 MV TO 1V INTO 50 OHMS, CALIBRATED OUTPUT $345.00
HP 618A SIGNAL GENERATOR, 1.8 GHZ TO 4.2 GHZ 0.1 MV TO 1V INTO 50 OHMS, CALIBRATED OUTPUT INTERNAL, EXTERNAL PULSE, FM MODULATION $375.00
HP-618B SIGNAL GENERATOR 3.8 GHZ TO 7.6 GHZ, 0.1 MV TO 1V INTO 50 OHMS, CALIBRATED OUTPUT, INTERNAL, EXTERNAL PULSE OR FM MODULATION $375.00
SG-587/URM-52 SIGNAL GENERATOR 3.8 GHZ TO 7.6 GHZ, MIL/SPEC MILITARY VERSION, SAME AS HP618B $325.00
HP620A SIGNAL GENERATOR, 7 GHZ TO 11 GHZ, CALIBRATED OUTPUT INTERNAL, EXTERNAL, PULSE FM MODULATION $450.00
HP 626A SIGNAL GENERATOR, 10 GHZ TO 15 GHZ INTERNAL, EXTERNAL, PULSE, SQUARE WAVE, FM MODULATION CALIBRATED OUTPUT, 10 MW TO 1 PW $650.00
HP 628A SIGNAL GENERATOR, 15 GHZ TO 21 GHZ, CALIBRATED OUTPUT 10 MW TO 1 PW INTERNAL, EXTERNAL, SQUAREWAVE, PULSE, FM MODULATION $850.00
URM-25 MILITARY SIGNAL GENERATOR, 10 KHZ TO 50 MHZ, RF OUTPUT 0 MV TO 2 VOLTS AM/CW 400/1000 HZ MODULATION, 50 OHM STOP ATTENUATOR, SMALL PORTABLE UNIT $245.00
URM-28 MILITARY SIGNAL GENERATOR, 4 MHZ TO 405 MHZ, CALIBRATED OUTPUT ATTENUATOR 0 MV TO 2 VOLTS, AM/CW 400/1000 HZ MODULATION, SMALL PORTABLE UNIT $245.00
MARCONI TF 1066B SIGNAL GENERATOR 10 MHZ TO 470 MHZ, AM/FM, CALIBRATED OUTPUT, INTERNAL FM OF 1 AND 5 KHZ WITH 100 KHZ VARIABLE DEVIATION, AM MODULATION OF 1 AND 5 KHZ, CALIBRATED RF OUTPUT 0 TO 200 MV $550.00
HP 5245L FREQUENCY COUNTER, MEASURES FREQUENCY, PERIOD, RATIO AND MULTIPLE RATIO MULTIPLE PERIOD AVERAGE, FREQ. RANGE 0 TO 50 MHZ WITH HP5253B PLUG-IN SUPPLIED, EXTENDS RANGE TO 500 MHZ, SOLID STATE COUNTER $375.00

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SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial offices, 73 Magazine, WGE Center, Peterborough NH 03458-1194.

WEBSTER MA
APR 27

The Eastern Connecticut Amateur Radio Association will hold the 12th annual ECARA Flea Market on April 27, from 10 a.m. to 2 p.m., at the 200 Sportsmens Club, Sutton Road, Webster MA 01570. Admission is $2; tables are $5 in advance and $7 at the door. Parking is free. For further information, contact Tom Francis KB1SP at (617)-943-7283, Dick Spahl K1SYI at (617)-943-4420, or Don Amirault K1APE at (203)-923-2727.

SIERRA VISTA AZ
MAY 2–4

The Cochise Amateur Radio Association will hold its 1986 hamfest on May 2–4 at the club's training facility on Moson Road (which intersects Route 90 five miles east of the 90/92 junction, in Sierra Vista). All ham-radio, computer, and related businesses are invited to attend. Ham exams on May 4. No charge for tailgaters; primitive overnight accommodations for RVs. Talk-in on 146.52 and 146.16/.76. For more information, contact Don Morgan W7ACI at (602)-458-5293 or write CARA at PO Box 1855, Sierra Vista AZ 85636.

FRESNO CA
MAY 2–4

The Fresno Amateur Radio Club will hold its 44th annual hamfest on May 2–4 at the Airport Holiday Inn. Inside air-conditioned dealer spaces and swap tables. FCC exams will be given; DX, emergency, and other programs; forums and demonstrations. Talk-in on 146.34/.94. For further information, contact Harry H. Billings, PO Box 783, Fresno CA 93712; (209)-268-6314.

OWEGO NY
MAY 3

The Southern Tier Amateur Radio Clubs will hold their 27th annual hamfest on Saturday, May 3, at the Treadway Inn, Owego, N.Y., beginning at 8 a.m. Flea market, vendor displays and sales, tech and nontech talks, and refreshments. A dinner at 6:30 p.m. (advance tickets only for the dinner). Take Route 17 to Exit 65. Talk-in on .22/.82, .16/.76, or 146.52 simplex. For further information, send an SASE to PO Box 7082, Endicott NY 13760.

BEMIDJI MN
MAY 3

The Bemidji ARC will sponsor a hamfest at 9 a.m. at the Bemidji Middle School on Saturday, May 3. Talk-in on 146.73. For further information, write the Bemidji ARC, PO Box 524, Bemidji MN 56601.

BATON ROUGE LA
MAY 3–4

The Baton Rouge ARC will hold its annual hamfest on May 3 and 4 at the Catholic High School on Heartstone Drive. VE Exams Saturday and Sunday at 8:30 a.m. A limited number of walk-ins will be accommodated. Send Form 610 and a check for $4.25 payable to ARRL/VEC to George Perry W5LVX, 17424 Lady Constance, Greenwell Springs LA 70739. Talk-in on 146.79/.19. For further information, send an SASE to Rick Pourciau NV5A, 879 Castle Kirk, Baton Rouge LA 70808, or call Shirl Cook K5OPL at (504)-766-0200.

GREENVILLE SC
MAY 3–4

The Blue Ridge Amateur Radio Society will sponsor the 47th annual Greenville Hamfest and Electronic Flea Market on May 3 and 4, at the American Legion Fairgrounds, one mile north of I-85 on Hwy. 25 N. VEC walk-in exams, dealer displays, indoor/outdoor flea market, packet and AMSAT demonstrations; S.C. SSB net, QCWA, ARRL, SCARDS, ARES; food, beverages, camping facilities available. Hours: 8 a.m. to 5 p.m. Saturday (early setup arrangements with advance registrations), 8 a.m.to 3 p.m. on Sunday. Admission is $3.50 in advance, $5 at the gate. Talk-in on 146.01/.61 (146.22/.82 backup). For advance registration, exam details, and further information, write the Blue Ridge ARS, Inc., PO Box 6751, Greenville SC 29606.

ROCKAWAY ARC
MAY 3–4

The Rockaway ARC will operate special-event station K2UHD from 1500 UTC on May 3 until 2100 UTC on May 4 to commemorate the 300th anniversary of the Founding of the Rockaways. Operation will be in the General (phone and CW) and Novice bands. For a certificate, send an SASE to K2UHD, Rockaway ARC, PO Box 214, Rockaway Park NY 11694.

CARMICHAEL CA
MAY 4

The North Hills ARC has moved HAMSWAP 86 to a new location at American River College, 4700 College Oak Drive, Carmichael, on Sunday, May 4, from 9 a.m. to 3 p.m. Free admission, free parking, advance table sales, food and drink available. Talk-in on K6IS repeaters: 145.19 and 224.78 MHz. For further information, write HAMSWAP 86, c/o NHRC, PO Box 41635, Sacramento CA 95841.

SANDWICH IL
MAY 4

The Kishwakee ARC will sponsor the 31st annual First-Sunday-In-May Hamfest on May 4 at the De Kalb County Fairgrounds, Suydam Road, Sandwich IL (just north of Route 34 between Routes 23 and 47, across from the airport). Admission is $2 in advance, $3 at the gate; inside display tables are $5. Outside areas for tailgating; parking is free. Overnight camping (no hookups); coffee and donuts for early birds, food wagon thereafter. Talk-in on 146.52, 444.45, and 146.13/.73. For tickets and/or further information, write to Box 21, Genoa IL 60135.

BOULDER CO
MAY 4

The Rocky Mountain VHF Society will hold its annual spring Ham Radio & Computer Swapfest on Sunday, May 4, from 9 a.m. to 3 p.m., rain or shine, at the Boulder National Guard Armory, 4750 N. Broadway, Boulder. Admission is $3 per family. Flea market, technical seminars, demonstrations, and free HT testing (spectrum analyzer, signal generator, power meter, frequency counter, and 12-volt power supply available). No extra charge for sellers; some tables available. Snack bar. Talk-in on the RMVHFS repeater, 146.16/.76 MHz. For further information, contact Dave McClune WB0ZID, 5338 Spotted Horse Trail, Boulder CO 80301; (303)-530-1872.

W. SPRINGFIELD MA
MAY 4

The Hampden County Radio Association will hold its annual flea market on Sunday, May 4 (rain or shine), from 9 a.m. to 3 p.m., at the West Springfield Elks Lodge covered pavilion on Morgan Road. Admission is $1; tables $5. There will be a $5 charge for each vehicle display. Food and refreshments available. Directions: Mass. Turnpike to W. Springfield Exit 4, 1/2 mile south on Route 5 to Abdow's Restaurant, turn right on Morgan Road; the Lodge is 3/4 mile on left. For further information, call Steve Nelson WA1EYF at (413)-596-8216.

EAST HARTFORD CT
MAY 4

The Pioneer Valley Radio Association will hold its annual flea market on May 4, at East Hartford High School (Penney High), 869 Forbes Street, from 9 a.m. to 3 p.m. (dealer setup at 8). Exams will be given by the Newington Amateur Radio League VE team; walk-ins accepted. General admission is $2; dealer tables are $8. Free parking. Talk-in on 146.19/.79. For further information or to reserve a table, contact Dave Rose KW1V, 13 Long Crossing Road, East Hamptom CT 06424; (203)-267-8993.

DEERFIELD NH
MAY 10

The Hosstraders will present their Spring Tailgate Swapfest on Saturday, May 10, at the Deerfield, N.H., Fairgrounds, benefitting the Shriners' Burns Hospitals (last year's gift: $11,754.46). Admission is $2 per person; no extra charge for tailgaters or vendors. Friday night camping at nominal fee, but no entry before 4 p.m. on Friday. Talk-in on 146.40/147.00. For a map, send an SASE to Nor-

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man B. Blake, RFD Box 57, West Baldwin ME 04091.

INTERNATIONAL BBQ
MAY 10

The Owensboro, Ky., ARC will operate K4HY from 0000 UTC May 10 to 0530 UTC May 11 on 7.245 phone to celebrate the International BBQ Festival. Certificate for SASE via N4EKG, 1615 East 23rd Street, Owensboro KY 42301.

MEDINA OH
MAY 11

The Medina County Hamfest, sponsored by the Medina Two-Meter Group, will be held at the Medina County Community Center Building, 735 Lafayette Rd. (State Rte. 42 S.W.), Medina, Ohio. Doors open for setup only at 6 a.m. and will be open for the public from 8 a.m. to 2 p.m. Free parking. Refreshments available. Tickets are $3.50 in advance, $4 at the door; tables are $6, flea-market space is $4. For advance reservations and tickets, write to PO Box 452, Medina OH 44258, or call (216)-725-4492 or (216)-769-3033. Talk-in on 147.63/.03 (K8TV/R).

ARMED FORCES DAY
MAY 17

The 37th annual Armed Forces Day will be recognized by Amateur Radio Station W4ODR, located Northside aboard Naval Air Station Memphis, Millington, Tenn. It will be operated by sailors and Marines from 1400Z to 2200Z on Saturday, May 17, continuously (it is hoped), as follows: SSB—7.230, 14.280, and 21.370 MHz (±10 kHz); CW—21.145 and 28.145 MHz; and 2m on 146.52 simplex. Visitors will be welcome.

Special red, white, and blue certificates will be available to those who work Whiskey Four Old Dusty Rebel. Same-day mailing and no SASE required! Calls not in the *Callbook* should QSL to Military Club Station W4ODR, PO Box 54278, Naval Air Station Memphis, Millington TN 38054.

For further information, contact Chief Petty Officer Bob Donan KA4FAL, Station Custodian at W4ODR, or call him at (901)-872-2007. Special Events NCO is Sergeant Major Jim Moffatt WD4SMW, at (901)-363-0778. The station phone is manned by off-duty personnel when the station is in operation: (901)-872-5134.

WOONSOCKET RI
MAY 17

The Rhode Island FM Repeater Service, Inc., will hold its annual spring flea market and auction on Saturday, May 17, from 9 a.m. to 5 p.m., at the American Legion Fairmount Post 85, 870 River Street, Woonsocket. Admission is free; flea-market spaces are $5 each. The auction begins at noon. Talk-in on .34/.94 and .52. For more information, contact Rick Fairweather K1KYI, Box 591, Harrisville RI 02830; (401)-568-3468 from 7–9 p.m.

CADILLAC MI
MAY 17

The Wexaukee ARA will sponsor its 26th annual Swap Shop at the Wexford Civic Arena, Jct. of N. Mitchell (U.S. 131) and 13th Street, on May 17th, from 8 a.m. to 2:30 p.m. Admission is $2.50; food and refreshments available. Talk-in on WD8RZL (.97/.37). For further information, write to PO Box 163, Cadillac MI 49601.

PITTSBURG KS
MAY 17

The Pittsburg Repeater Organization, Inc., will hold its 1986 Hamfest in the Lincoln Park Pavilion, Pittsburg, on Saturday, May 17, from 10 a.m. to 8 p.m. Free tables; covered dish dinner at 6 p.m., chicken and beverage furnished by the club. Talk-in on .34/.94 or .84/.24. For further information, write Ken Johnston, PO Box 1303, Pittsburg KS 66762.

SAC MUSEUM
MAY 17

The Omaha, Nebraska, AKSARBEN ARC will operate station W0EQU from 1400 UTC to 2300 UTC on May 17 from the Strategic Air Command Museum in celebration of Armed Forces Day. Operation will be in the lower 25 kHz of the 10–80-meter General bands. Send a QSL and an SASE to AKSARBEN ARC W0EQU, Box 291 D.T.S., Omaha NE 68101.

BRENHAM TX
MAY 17–18

The Brenham ARC will sponsor the Brenham Springfest on May 17–18 (10 a.m. to 6 p.m. on Saturday; 8 a.m. to 4 p.m. on Sunday) at the Washington County Fairgrounds, Brenham. Admission is free and tables are $5. Talk-in on 147.26/.86. For more information, contact J. McDermott, PO Box 162, Brenham TX 77833; (409)-289-3600 from 7 a.m. to 3 p.m. CST.

ZILWAUKEE BRIDGE
MAY 17–18

The Bay Area ARC and the Saginaw Valley ARA will operate stations K8DAC and N8GKM from 0000 UTC on May 17 through 2400 UTC on May 18 from the Zilwaukee Bridge, the only drawbridge on the U.S. Interstate system, to commemorate Michigan Week. To earn a certificate you must contact both stations. Operation will be about 20 kHz above the General and Novice splits on 20, 40, 80, and 160. Send an SASE with 44 cents postage or an IRC to SVARA/BVARC Special Event, PO Box 1783, Saginaw MI 48605-1783.

HOLY LAND, U.S.A.
MAY 17–18

The Waterbury, Conn., ARC will operate a special-event station from Holy Land, U.S.A.—a miniaturized replica of the Holy Land at the time of Christ, atop Pine Hill, overlooking the city of Waterbury—on May 17 and 18. Callsign will be KA1YP, and the operation will run during daylight hours on 40-, 20-, and 15-meter SSB. QSL (SASE only) to *Callbook* address. Richard A. Jacovino KA1YP, 101 Woodbine Street, Waterbury CT 06705.

VE1 ABEGWEIT AWARD
MAY 18

The Prince Edward Island Amateur Radio Association will sponsor a special event featuring the little-known Abegweit Award on Sunday, May 18, from 1200 to 0000 UTC, SSB and CW only, with bands changing according to band conditions. CW—21.100, 14.050, 7.100, and 3.700; SSB—21.300, 14.250, 7.200, and 3.800.

Abegweit, a Micmac Indian word meaning "Cradled on the Waves," was the earliest name for PEI, which is located in the Gulf of St. Lawrence.

VE1 and VO1 stations must confirm contacts in all three PEI counties (Prince, Queens, and Kings). All other VEs and U.S. amateurs must confirm any three PEI stations. All amateurs other than continental United States and Canada must confirm two PEI contacts. Any such contacts since January 1, 1960, are valid.

Send a copy of the log, certified by two other amateurs, and $2 or 10 IRCs to PO Box 1232, Charlottetown, Prince Edward Island, Canada C1A 7M8. For further information, contact David A. Smith VE1CIK, Box 529, Kensington, Prince Edward Island, Canada C0B 1M0; (902)-836-4246 after 2200 UTC.

WABASH IN
MAY 18

The Wabash County ARC will sponsor The Indiana Hamfest on Sunday, May 18, beginning at 6 a.m. (setup time Saturday afternoon and evening), at the Wabash County 4-H Fairgrounds in Wabash, Ind. Overnight free parking for campers; tables available. Exams for Tech through Extra, 8 a.m. until noon. Admission will be $2.75 in advance, $3.25 at the door. Talk-in on 147.63/.03, 146.52/.52, and 146.94/.94. For more information, contact Donald Spangler W9HNO, 235 Southwood Drive, Wabash IN 46992; (219)-563-5564.

WILLINGBORO NJ
MAY 18

The Willingboro, N.J., Repeater Group will hold its annual Hamfest on Sunday, May 18, from 8 a.m. to 3 p.m. (setup from 6 a.m.) at the Holiday Lakes, Route 130 and Creek Road, Willingboro. Admission $3 (adults) or $2 in advance, $5 for table space/tailgate. Talk-in on 146.925, 224.860, and 146.52. For further information, contact Jack Engel K2KLM, PO Box 31, Rancocas NJ 08073; (609)-877-5249 after 6 p.m.

PARAMUS NJ
MAY 18

The Bergen ARA will hold a Ham Swap 'N' Sell on Sunday, May 18, from 8 a.m. to 4 p.m., at Bergen Community College, 400 Paramus Road, Paramus. Tailgating only; bring your own tables. Amateur license exams. Buyers free; sellers $5. Thousands of spaces. Talk-in on .79/.19 and .52. For further information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450; (201)-445-2855 nights only.

UNION ELECTRIC COMPANY
MAY 18

The Union Electric Ham Radio Club will operate special-event station KA0AWS on May 18 from 1800–2300 UTC to honor the employees of the Union Electric Company (serving parts of Missouri, Illinois, and Iowa). Operation will be 25 kHz up from the lower edges of the General portions of 80, 40, and 20 meters, and also on a 10-meter FM repeater on 29.620/.520 and a 10-meter repeater on 147.06/.66. Send your contact number and a large SASE (39 cents) for an 8-1/2 x 11 certificate to: Henry G. Schaper, Jr. KA0AWS, 241 Tapestry Drive, St. Louis MO 63129.

TAYLOR MO
MAY 18

The Western Illinois ARC will hold its 1986 Tri-State Swapfest (from 9 a.m. to 3 p.m.) in conjunction with the Experimental Aircraft Association's Fly-In Breakfast on Sunday, May 18, at Haerr Field, Taylor, Mo. (five miles west of Quincy, Ill., at the junction of State Routes 61 and 24). VEC exams will be offered for all license classes. Admission tickets $1 each or 6 for $5; tailgate flea-market spaces $2 in advance or $3 at the gate. Talk-in on the 147.03 repeater. For further information, write the Western Illinois ARC, PO Box 3132, Quincy IL 62301.

OMAHA NE
MAY 18

The AK-SAR-BEN ARC will host its annual auction on Sunday, May 18, at the Radial Social Hall, 1516 Northwest Radial Highway, Omaha, at 9:15 a.m. (equipment check-in starts at 8 a.m.). Food and beverages on the premises. No admission charge. Talk-in on 146.34/.94. For further information, call Greg N0BTN at (402)-895-5219.

FREMONT OH
MAY 18

The Sandusky Valley ARC will hold its annual hamfest at the American Legion Home, 2000 Buckland Ave., Fremont, Ohio (southwest edge of Fremont), on May 18, starting at 8 a.m. (open at 6 a.m. for setup). Advance admission $2.50; $3 at the door; 8-foot table space $6; free tailgate/trunk space; free parking. Talk-in on .52 simplex or 146.31/.91. For tickets and further information, send an SASE to Pat. D. Keating WB8KWD, 615 Lime St., Fremont OH 43420.

DALTON MA
MAY 18

The Northern Berkshire ARC will sponsor its annual Spring Flea Market at the Dalton American Legion, Route 9, Dalton, on Sunday, May 18, beginning at sunrise. Admission is $1; XYLs and YLs admitted free; refreshments by NOBARC. For further information, send an SASE to NOBARC, PO Box 591, Williamstown MA 01267.

ATHENS OH
MAY 18

The Athens County Amateur Radio Association will sponsor its 7th annual hamfest on Sunday, May 18, in the City Recreation Center on East State Street, from 8 a.m. to 3 p.m. The focus will be on the use of computer technology in ham radio. Packet-radio demonstration. Outdoor (paved) flea-market space free for tailgating or your own tables; indoor space by reservation only through Sam Stewart KA8NIE, 116 Franklin Avenue, Athens OH 45701; (614) 592-5330. License exams for all levels. Walk-ins accepted. Hamfest admission is $3 in advance and $4 at the gate. Talk-in on 146.34/.94. For further information, write Carl J. Denbow KA8JXG, 63 Morris Avenue, Athens OH 45701.

OLD WESTBURY NY
MAY 18

LIMARC will sponsor an ARRL outdoor hamfest at the N.Y. Institute of Technology, Northern Blvd., Rte. 25A, 1 mile east of Glen Cove Road in Old Westbury (Exit 39N-Rte. 25A), from 9 a.m. to 3 p.m. (7:30 a.m. for sellers). Plenty of parking; catered food. General admission for hams is $3. For further information, write Hank Wener WB2ALW, 53 Sherrard St., East Hills NY 11577, or call the LIMARC Infoline at (516)-796-2366.

CICERO IL
MAY 18

The 900-MHz Users Group will sponsor an all-indoors hamfest on Sunday, May 18, at the Palace Hall, Central & Cermak, in Cicero, Ill., beginning at 7 a.m. Coffee, rolls, and food will be available. Tickets are $3 each; tables supplied at $5 each. Talk-in on 146.52. For further information, write the 900-MHz Users Group, 2247 N. Spaulding, Chicago IL 60647.

PICCOLO SPOLETO FESTIVAL
MAY 24–JUN 7

The Trident ARC will operate N4EE to commemorate the Piccolo Spoleto Festival's ninth season of presenting local and southeastern regional talent from every artistic discipline, as follows: 1400 UTC to 2400 UTC on May 24–25, May 31–June 1, and June 7. SSB—7.249, 14.240, 21.340, and 28.540; CW—7.120 and 21.120. Certificate for QSL and large SASE to TARA, PO Box 73, Summerville SC 29484–0073.

WEST FRIENDSHIP MD
MAY 25

The Maryland FM Association's annual hamfest will be held on Sunday, May 25, from 8 a.m. to 4 p.m., at the Howard County Fairgrounds, West Friendship, (I-70, 30 miles west of Baltimore). Inside tables $7 by reservation, $10 at the door (if available). Donation is $3. Talk-in on 146.16/.76, 222.16/223.76, or 449.1/444.1 MHz. For tables or information, contact Michael Cresap W3IP, 1921 Pometacom Drive, Hanover MD 21076; (301)-551-3567 between 6 and 10 p.m.

HUMBOLDT TN
JUN 1

The Humboldt ARC will sponsor its annual hamfest on Sunday, June 1, at Bailey Park, 22nd Avenue, Humboldt, from 8 a.m. to 4 p.m. Admission is $1; food and refreshments available. Flea market; ladies' activities; parking for RVs. Talk-in on .37/.97. For further information, contact Ed Holmes W4IGW, 501 N. 18th Avenue, Humboldt TN 38343.

MILESTONES OF MEMORIES
JUN 6–8

The Wichita (Kansas) ARC station, W0SOE, will be operating from Lewis, Kan., on June 6, 7, and 8 to help celebrate its centennial. The Milestones of Memories operation will be on approximately 3.875, 7.250, 14.250, and 21.325 MHz. QSL via W0SOE, Wichita ARC, 707 N. Main, Wichita KS 67203.

OHIO WINE MONTH
JUN 7–8

WINO (Wireless Institute of Northern Ohio), an organization sponsored by the Lake County Amateur Radio Association, will be on the air from a winery in Madison, Ohio, with the call KO8O, to commemorate Ohio Wine Month. Operation will be on 3860 and 7235 kHz from 2300 UTC to 0300 UTC, Saturday, June 7, and on 7235 and 14,235 kHz

from 1500 UTC to 1900 UTC on Sunday. For a special 8-1/2 x 11 certificate, send a legal-size SASE to KO8O WINO Weekend, 7126 Andover Drive, Mentor OH 44060.

ST. PAUL MN
JUNE 6–7

The North Area Repeater Association will sponsor its Amateur Fair on the weekend of June 6 and 7 at the Minnesota State Fairgrounds in St. Paul, Minn. Admission is $4 in advance or $5 at the Fair. Amateur license exams will be given. Giant outdoor flea market, exhibits, commercial dealers. Free overnight parking June 6 and 7 for self-contained campers. Talk-in on .25/.85 or .16/.76 repeaters. For dealer inquiries, tickets, and further information, write Amateur Fair, PO Box 857, Hopkins MN 55343, or call (612)-566-4000.

LIGHTSHIP PORTSMOUTH
JUN 6–8

The Portsmouth (Virginia) ARC will operate W4POX on June 6–8, 1500–0800 UTC daily, from the Lightship Portsmouth at the Portsmouth Seawall Festival. Frequencies are 7.230 and 14.290. For a comemorative QSL, send a QSL and an SASE to W4POX, 4800 Manor Avenue, Portsmouth VA 23703. For a QSL and a certificate, send your card and a 9 X 12 envelope with 44 cents postage.

GUELPH ONT
JUN 7

The Kitchener-Waterloo ARC will sponsor the 12th annual Central Ontario Amateur Radio Flea Market and Computerfest on Saturday, June 7, from 8 a.m. to 2 p.m., at the Col. John McRae Legion Hall, Guelph. Admission is $2. Inside space is $8 (table included). Outside space is $3. Talk-in on 147.960/.360 and .52. For more information, write the Kitchener-Waterloo ARC, PO Box 812, Kitchener, Ontario, Canada N2J 4C2, or call Paul VE3CHM at (519)-579-3057.

25TH ANNIVERSARY
FAIR LAWN NJ ARC
JUN 7–8

The Fair Lawn ARC will operate the club station under founding-member Frank Leonard's call, W2NPT, to commemorate the 25th Anniversary of the club. Operation will be from 1300 to 2200 UTC on the 7th and from 1400 to 1500 UTC on the 8th. Frequencies: CW—7.050, 7.110, 14.050, and 21.050 (±10 kHz); phone—7.285, 14.285, and 21.385 (±10 kHz). For a certificate, send QSL and SASE to Frank Leonard W2NPT, 17–12 Well Drive, Fair Lawn NJ 07410.

BSA SCOUT-O-RAMA
JUN 14

The Chicago Suburban Radio Association will operate its third annual special-event amateur-radio station, N9BAT, from the Brookfield Zoo, Brookfield, Ill., on June 14, from 1500 to 2300 UTC, as part of the West Suburban Council, BSA, annual Scout-O-Rama. Frequencies: 7.250 and 14.250 MHz. A special full-color QSL card available for a QSL card and business-size (#10) SASE to N9BAT Special Event, PO Box 88, Lyons IL 60534.

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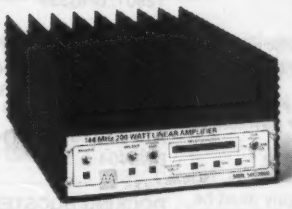

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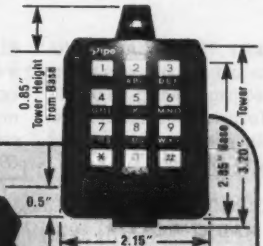

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2. Winner will be selected in a random drawing from among all entries received, under the supervision of the publisher of *73 Amateur Radio*, whose decision will be final. Only one prize will be awarded in this Sweepstakes. Winner will be notified by mail and may be required to execute an affidavit of eligibility and release. Odds of winning will depend on number of entries received. The publisher of *73 Amateur Radio* will arrange delivery of prize. Taxes are the responsibility of the winner. Any manufacturer's warranties will apply, but the publisher makes no warranties with regard to any prizes. Prize is not transferable. No substitution for prize.

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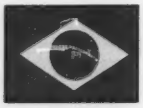
73 INTERNATIONAL

Just because I started this column as a result of visiting DX hams is no reason you shouldn't put in your 2¢ worth and let me know what DX news you find most interesting. My inclination is to have DX ops tell us what they think is interesting—how we can get permission to operate if we're fortunate enough to visit—any coming DXpeditions—what's doing with repeaters—things like that. What do YOU find most interesting? Since we have a world hobby, I think you'll be as interested as I in what is going on. If nothing else, it gives us something to talk about on the air which, from what I'm hearing these days, can't hurt.

—Wayne.



BRAZIL

Gerson Rissin PY1APS
PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

BRAZILIAN AMATEURS IN ANTARCTICA

The third Antarctica Mission, sponsored by the Brazilian Navy, had in its crew two amateurs who put on the air for the first time the station ZX0ECF, located on the King George Island, South Shetlands. Its geographic coordinates are 62.05 south and 58.23 west. The amateurs were Sinval Viana Silva PY1AFP and Nilson Gomes Silva PY1AFQ. They both used the special call above, issued by the Brazilian Communications Department (DENTEL) only for this event.

The equipment used was a Harris, which worked from 2 to 30 MHz, developing about 125 Watts, and an omnidirectional whip about 35 feet high. They were very active on 14 MHz, more in SSB than in CW because they had hard traffic between the crew (composed of 22 persons) and their families in Brazil. Meanwhile, they were able to work about 1500 different stations.

Last year, ZX0ECF went QRT on April 30. The QSL information is PY1AFP or PY1AFQ, PO Box 58, 20001 Rio de Janeiro, RJ, Brazil. In 1986, during the 4th mission, ZX0ECF will be on the air again for about five months.

In spite of affirming the Pact of Antarctica in 1975, Brazil started its scientific studies there only in 1982. During the second expedition a few regions were checked to decide where would be the best place to have the base. At first, five points were chosen to be visited: Dorian Bay, Port Lock Roy, Py Point, Andword Bay, and King George Island.

The last was determined to be the best because it has a wide area, a good place to anchor ships, and especially, was near a few foreign bases such as Teniente Rudolph Marsh (Chile), Jubany-Poter Cover (Argentina), Bellinghshausen (Soviet Union), Arctowski (Poland) and Chinese Wall (China), where they could have all kinds of help, considering that Brazil was a newcomer in that region. The assembly of the base lasted twelve days, and about 200 friends from the other bases came for its inauguration: the Brazilian base, the Comandante Ferraz Antarctica Station.

PIONEIROS RADIO CLUBE

Installed February 27, 1982, in the city of Recife, the PRC (Pioneers Radio Club) is a nonprofit organization of professional CW operators, active or retired, who are also ham operators. You may apply for membership by sending a copy of your professional license, your QSL card and 10 IRCs.

The Club was first directed by PY7HQ, PY7FI, PY7PO, (now PR7PO), and PY7FY. Carlos PY7HQ is still president. The PRC recognizes pioneer CW operators who maintained for many years in the past the only reliable kind of transmission. Already 49 Brazilian and 4 foreign amateurs have joined the PRC.

One of the activities of the Club is sponsoring the Worked Maritime Mobile Award (WMM), which is available to all licensed amateurs for confirmed contacts with 5 (five) stations maritime mobile of five different countries. For example: PY1ASI/MM, OH1SY/MM, JF6LZT/MM, DK2MI/MM, and YU3AG/MM.

Contacts must have been made after February 27, 1982, on any amateur band, only two-way CW mode. Minimum report is 338. Send your list of stations worked (call, date, time, band, mode, and report), copies of the five received /MM QSLs, and 10 IRCs for mailing expenses to: PRC, PO Box 1470, 5000 Recife, PE, Brazil.

REPUBLIC OF CHINA

Tim S.H. Chen BV2A/BV2B
PO Box 30–547
Taipei, Taiwan, 107
Republic of China

GOLDWATER VISITS

United States Senator Barry Goldwater K7UGA recently made a trip to Taipei, Republic of China; this long-wished-for expedition was postponed since November, 1984. The mission consisted of seven members, including the Senator himself, David Siddall K3ZJ, Larry Kettlewell W3HHG, Thomas J. Warren K3TX, Roland McElroy K4OCI, Jeff Hutchinson W4PBC and Karl Renz K4YT.

K4YT came from Manila alone and the others arrived in Taipei on January 2, 1986 during the New Year holiday. Three monobander beam antennas for 15, 20, and 40 meters with 2 linear amplifiers, 30L-1 and Dentron MLA 2500, were brought in from Manila and the States. The antennas were transported from the international airport to Taipei and immediately installed at two different locations for the seven-day operation. In addition, four transceivers, TS-930S, FT-901D, TS-430, and IC-741, were borrowed from local hams.

The two locations are separated by about 3 km, one of them the same QTH near the suburb park provided for use by the six DXpedition groups in the past, and the other, a new QTH situated at a high-rise 13-story building downtown. These arrangements were made in honor of Senator Goldwater, who would open the station, and for the convenience of simultaneous operating without causing any interference.

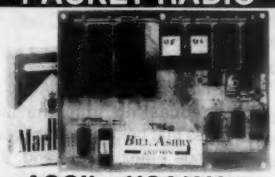
At 5 p.m. on January 5, Mr. Lien Chan, Minister of Communications, personally handed station license BV0BG to Senator Goldwater, wishing him every success for the DXpedition. The Minister said, "This is really a unique activity."

There were about 20 reporters from local TV stations and news agencies crowded in the station. The flashlights and floodlights made the decorated hall even brighter and more colorful for photographing. Our activities caught all eyes with admiration through the three TVs and most important papers on the following day.

Mr. Y.C. Huang (ex-C9YC), Secretary General of the China Radio Association, presented the senator with a hand-painted scroll with a picture of the senator standing beside a gnarled pine tree. The picture depicts the idea of longevity, and the senator accepted it with great pleasure. Six ham members of the mission also received a medal with a certificate of appreciation and a souvenir from the CRA. Meanwhile, Senator

Senator Goldwater received the BV0BG station license from Minister Lien Chan. David Siddall K3ZJ looked on.

PACKET RADIO



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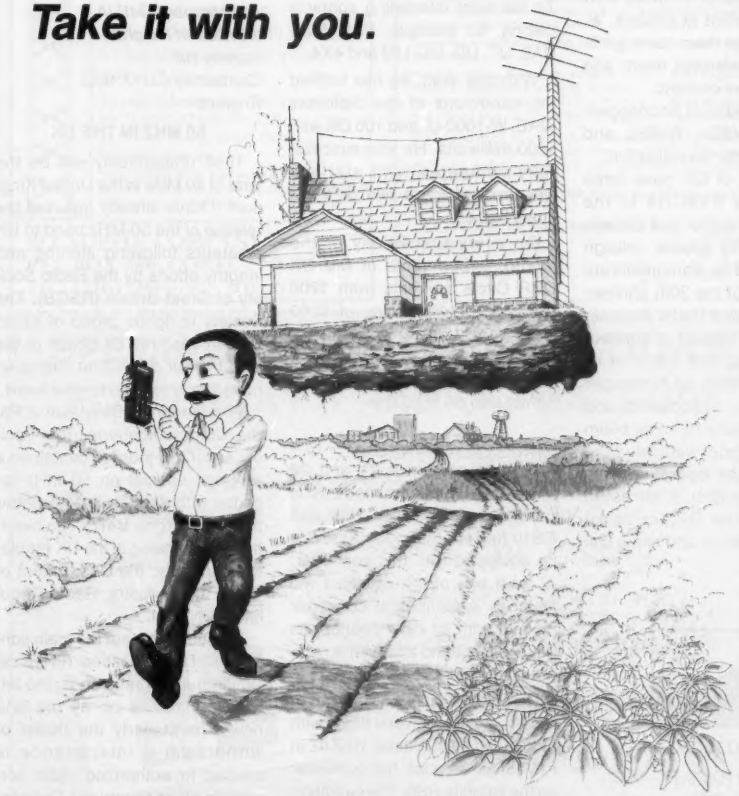

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At the China Radio Association Banquet, (l to r) Roland McElroy K4OCI, Larry Kettlewell W3HHG, Y. C. Huang, ex-C9YC, David Siddall K3ZJ, Karl Renz K4YT, Garry Denitto of AIT, Thomas Warren K3TW, Jeff Hutchinson W4PBC, Tim Chen BV2A/BV2B, and H.C. Hu, Secretary of CRA.

Goldwater honored the CRA by giving a set of American-published amateur radio literature to BV2A/BV2B (the writer), as chairman of CRA Amateur Radio Commission. It included a copy of the ARRL 1986 *Radio Amateur's Handbook* bearing the Senator's autograph.

Returning to a CQ call, five stations from Marshall Island, Japan, and the Philippines got contact with the senator. It was regretful that he could not hold on longer on the air owing to participating in another party. Then someone else took over the mike and continued the QSOs.

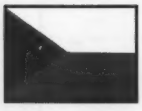
That evening a banquet was hosted by the China Radio Association at the Lai Lai Sheraton Hotel to welcome the DXpedition as well as to commemorate mutual goodwill and friendship. Many officials of the government's Information Office, Ministry of Foreign Affairs, Ministry of Communications, and the American Institute in Taiwan were present. The party ended in joy.

On January 10, the mission was satisfactorily accomplished and all members left for the States. By a rough estimate there were approximately 7000 QSOs with 73 countries contacted on 160, 80, 40, 20, 15, and 10 meters. It is noted that the mission initiated the use of 160 and 80 in this area, but this was a temporary measure, specially approved for the expedition, and can not to be considered as a practice. 80-meter operation created some TVI, which we should try to remedy.

Many new ham calls are active on 7, 14, and 21 MHz. From this area, they are BV2DA, BV2FA, BV5HA, BV6IA, BV7JA, BV7KA, and BV7LA. Moreover, BV2GA, BV7MA, BV5NA, BV2OA and BV8PA are underway to complete their installations within one or two months. Most of these new ones run barefoot at present, although some of them have got 3-element or 5-element beam and linear amplifiers on hand.

Also, be aware of bootleggers —BV9CR, BV0BA, BV0RL and BV0JC are under investigation.

Thousands of DX have been contacted by BV0CRA in the months of November and December, 1985. This special callsign was assigned to commemorate the occasion of the 30th anniversary of the China Radio Association. A demonstration of amateur radio operating took place at its annual convention on November 30, 1985. Two transceivers and two antennas (one 15-meter beam and one tribander vertical) were installed for the operation from morning till night; it attracted 500 visitors. The QSL cards for BV0CRA are ready and being dispatched.



CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenskeho 1477/8
955 01 Topolcany
Czechoslovakia

QRP IN CZECHOSLOVAKIA

To the list of other OK stations that deal with operation with low power belong also OK1DNM, OK2SAH, and OK3CXS. Milan OK1DNM works with various powers from 50 Watts to 9 Watts. Among his connections there are some partials that have been made with an input between 50 and 100 milliwatts by CW and from 100 milliwatts to 3 Watts operating SSB. With his contacts with VE1 on 14 MHz by 4 Watts and with F on 10 MHz by 50 milliwatts, Milan fulfilled the condition of the diploma 1000 milliwatts.

Alois OK2SAH works on various bands with the longwire antenna by a transceiver of 5 Watts. The transceiver is his own product and it is a faithful copy of the Argonaut of the Ten-Tec firm.

Peter OK3CXS specializes in the 160-meter band where he uses the transceiver M-160 (made in Czechoslovakia) and thanks to the excellent antenna he reaches remarkable results. On the abovementioned band, operating QRP, he has made more than 1000 contacts with 46 states on three continents, according to the DXCC list. To his most interesting contacts belong, for example: EA9, SV5, UA9, UF, UG, UL, UM and 4X4.

With one Watt, he has fulfilled the conditions of the diplomas WAE, W-1000-U, and 100 OK with 1000 milliwatts. He also successfully competes with stations whose capacity is two or three times higher.

On every first Friday of the month, experiments of the OK QRP Circle are held from 1700 UTC on the frequency of 3560 kHz, from 1800 UTC with less than 1 Watt, and from 1900 UTC, with a sufficient number of participants, also on 1875 kHz.

RS SATELLITES

For the converter 21 and 29 MHz, the indication mode K is used. Soviet satellites RS9 and RS10 (except the mode A) are to be equipped with this converter. At least one of the satellites will have an experimental converter mode T with an input channel on the 21-MHz band and with an output on the 145 MHz.

During April 1985, Ondrej OK3AU worked several times with the station from Alaska, KL7JIZ in Fairbanks, through the converter on the satellite RS8. The condition for making contacts for such a great distance lasted approximately 90 seconds.

RTTY

The members of the Radioclub OK1KRY from Rokycany are again very active when operating RTTY. They use the converter ST-5, the teleprinter T-51 and the transceiver "OTAVA" (80–10 meters operation CW/SSB, input of 70 Watts, the product of the firm Radiotechnique in Czechoslovakia). With the help of RTTY they were working with 80 countries according to the DXCC list.

DX

The station EO1AOK was broadcasting from the island Heiss that belongs to the group of islands Franz Jozef Land. If you had been working with it, send QSL via UZ1OWA. In winter 1985/86, UV1OO, UA1OT, and UZ3DD/1 were able to be active from Franz Jozef Land. For all stations, UZ1OWA is manager.

GREAT BRITAIN

Jeff Maynard G4EJA
32 Waldorf Heights
Halwey Hill
Camberley GU17 9JQ
England

50 MHZ IN THE UK

1986 undoubtedly will be the year of 50 MHz in the United Kingdom. I have already reported the release of the 50-MHz band to UK amateurs following sterling and lengthy efforts by the Radio Society of Great Britain (RSGB). The Society is rightly proud of its efforts in this area on behalf of the UK amateur population, losing no opportunity to let everyone know.

The January 1986 edition of *Radio Communications*, the Society's monthly journal, contained a six-page special on 50 MHz together with a facsimile of the letter received from Barry Maxwell, head of licensing at the UK regulatory authority, the Department of Trade and Industry, Radio Regulatory Division.

The letter sets out the main conditions of the allocation. (In typical British bureaucratic style, the letter emphasis is on all the bad news, particularly the threat of withdrawal if interference is caused to authorized radio services in other countries.) The conditions are:

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Continued on page 104

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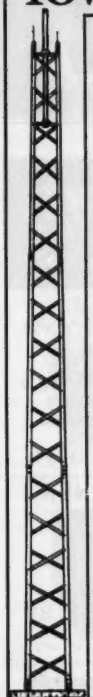

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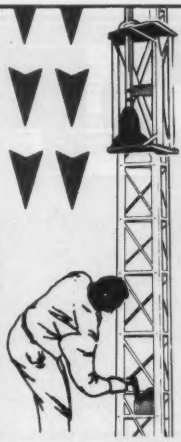

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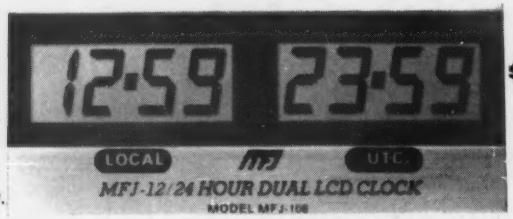

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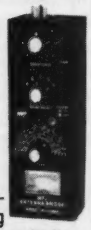

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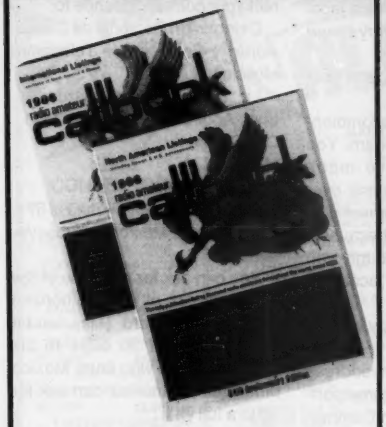

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73 INTERNATIONAL

from page 100

from the amateur's fixed (home) station

•no repeaters permitted.

The existing special permits for restricted use of 50 MHz by a small number of amateurs are withdrawn. There are no limitations on the mode of operation to be allowed on 50 MHz, so we can expect to see SSTV, RTTY, fax, and data as well as the more traditional modes. With the full availability of 50 MHz from 1st February 1986, it is likely that a number of *73* readers will have added UK contacts to their band totals by the time this is read.

The most significant restrictions seem to be the combination of antenna height and polarization, fixed station operation, and limited power. The regulatory officials are very concerned at the potential for interference with Band 1 television stations in nearby countries. Belgium and Norway particularly are at risk from stations in the south of England and northeast Scotland, respectively.

Clearly the needs of other spectrum users must be properly considered, but I am not sure what answer one would give an Antwerp TV viewer plagued with interference in the middle of a lift...

Just to remind those looking for UK contacts on 50 MHz, there are three 6-meter beacons in the UK: GB3RMK on 50.006, GB3SIX on 50.020, and GB3NHQ on 50.050. GB3SIX has the most power at 100 Watts erp, and is the only beacon to beam west towards the new countries.

You will recall that a full (Class A) license in the UK requires the applicant to pass a Morse test (12 wpm send and receive) in addition to the written examination. To date, Morse tests have been conducted by the Maritime Branch of British Telecom on behalf of the Department of Trade and Industry. Taking a test has been possible at more or less any time (by appointment) but has necessitated a visit to the Maritime Branch's nearest shore station—often a considerable journey.

From April 1, 1986 tests will be available at over 70 testing centers throughout the UK, with every county having at least one location. Tests will be held every two months in each center and at £7, will be less than half the present fee. Once again the improvements are due to the RSGB who have successfully competed with the City & Guilds and British Telecom for the "contract" to operate the service on behalf of the Department.

The RSGB-recorded "newsletter" is updated frequently and provides up-to-the-minute information on happenings in the amateur scene in the UK. The number is 707 52242 (from the US, precede this with 01144).

MEXICO

Mark Toutjian XE1MKT
Apartado Postal 42–048
06470–Mexico D.F.

TRAVELING TO MEXICO?

Traveling to Mexico? You say you would like to get a temporary ham license so you can operate during your stay here? Then I am pleased to provide the following new information.

Since there is no reciprocal agreement between Mexico and the United States and some other countries, obtaining a permanent license may not be possible—unless you want to take the tests involved (in Spanish). However, if you plan to visit Mexico on a temporary basis, how about a temporary license (mobile and/or base station)?

If this is what you want, here are the rules:

1. You must already be a legal ham operator in the country where you reside.

2. Present a photocopy of your valid license.

3. Obtain a letter of recommendation from a Mexican ham. You probably already have made friends with Mexican hams over the air waves. (Note: I cannot give out recommendations because I am not Mexican—although you would never tell by my accent—ha!)

4. Present a photocopy of your tourist card.

5. Indicate in writing an address in Mexico where any correspondence from the Mexican Communications Bureau can be sent to you while you are in Mexico.

6. Indicate in writing where your base station will be located.

7. If you plan to operate mobile, indicate in writing your probable itinerary—locations and dates—during your stay.

8. Be sure to keep an accurate log of *all* your contacts made from within the country, and send a copy of this to the Mexican Communications Bureau as soon as you leave the country.

All of your correspondence can be directed to:

Dirección General de Concesiones y Permisos de Telecomunicaiones
Dirección de Control de Operación de Sistemas Radio Eléctricas
Apartado Postal 55-258
Col. Iztapalapa
09820–Mexico, D.F.
Telephone in Mexico City: 692-0412. Ask for Raymundo Méndez or Jesús Alberto Felix. (A little Spanish will help.) They will be pleased to help you.

If you plan to stay in the border area around Tijuana, you can direct your correspondence to:

Delegación Regional de Concesiones y Permisos de Telecomunicaciones
Lic. Héctor Bravos Velarde
Blvd. Adolfo López Mateos 1431
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The telephone in Tijuana is 571-208. Ask for Héctor Bravos Velarde.

You can ask for a license of the same amount of time authorized on your tourist card. (This can be anywhere from 30 days to six months.) Some who enter Mexico other than as tourists can ask for up to a full year.

It would be good to plan to get your tourist card (or visa) well in advance so that you can include a photocopy of it in your letter with the *other* requirements. Of course, this would be advisable for all of the above points.

Hope this helps answer the many inquiries I have received by mail. I had written to some of you, mentioning that you would have to apply for a permanent license and take the usual tests. However, the above is *new* information that will hopefully be useful for your next trip to Mexico! So, enjoy your vacation and "hasta pronto."

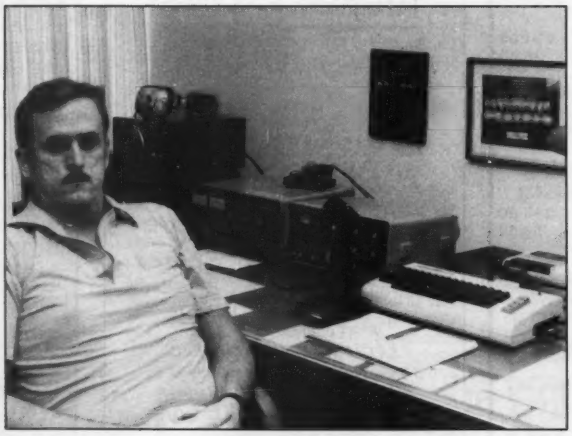
MOZAMBIQUE

Charles E. Martin AB4Y
American Embassy
Department of State
Washington DC 20520

The views and opinions presented are my own and not necessarily those of the State Department or the US Government.

This is my final column from Mozambique. Sadly, I have not been able to secure operating permission. Amateur radio remains "suspended" in the People's Republic of Mozambique, and unless conditions change radically the suspension is not likely to be lifted soon.

The medium- to long-term outlook is, however, promising. Rui Fernandes, the director of CTT (the *parastatal* that administers telecommunications in the Re-



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public) is now receiving *QST* and *73* every month. The many positive aspects of amateur radio are now regularly seen by an individual who may be important in returning amateur radio to this country.

Mozambique is a member of SATA (Southern African Telecommunications Administration). SATA is a suborganization of the Southern Africa Development Coordination Conference. The long-term goal of SATA is to expand and link the telecommunications structure of the various member states. A number of telecommunications projects are underway in Mozambique, including expansions of both in-country telephone and telex services and a new satellite communications terminal in the port city of Beira.

By way of statistics, Mozambique, a country of some 14 million people, has about 52,000 telephones—or one per every 270 people. Most of these telephones are in Maputo. (By comparison, there are more telephones in Tokyo than in all of Africa.) SATA has a formidable task ahead of it. Most of the technicians involved in the upgrade projects are foreigners and are paid in foreign currency, which usually is in short supply in Africa.

All SATA member states except Mozambique permit amateur radio in their respective countries. Perhaps Mozambique will re-authorize amateur radio as a step toward rehabilitating the telecommunications infrastructure and providing a source of trained technicians in the future.

I have been posted to the American Embassy in Paris, France. If you are ever in the neighborhood, just drop by. I will, fortunately, be licensed in France, and I plan to do a great deal of operating. After two long years without amateur radio privileges, it will be great to get back on the air. Perhaps a DX-pedition to C31 or 3A can be arranged.

I am grateful to Perry KW1O and the staff at *73* magazine for the opportunity to write this column. I am sad only about the fact that I could not report any return of amateur radio to Mozambique.

73 and God bless.

POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

POLISH USW CLUB

On June 8th and 9th, 1985, the XXIV Conference of the Polish USW Club took place in Bydgoszcz. The Polish USW movement was represented by 90 participants, among them 50 full members of the club. The Conference elected a new board, with SP9EHS as the president, SP2DDV as secretary, SP9GMT as technical manager, SP6GWN the treasurer and SP6AZT the member at large.

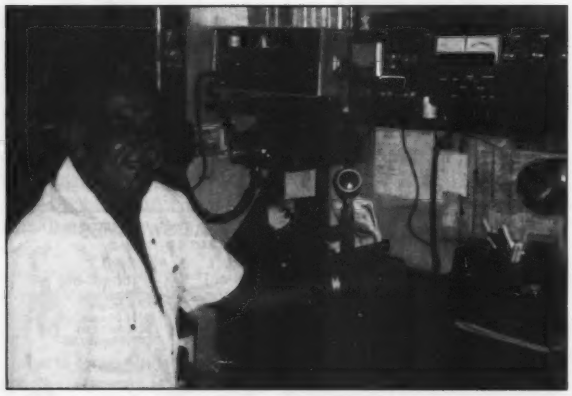
During an hour-long discussion, 19 motions had been brought forward but only 16 of them were adopted. Regarding a contest organized by Eastern Bloc countries, under the name "Victory 41," the Conference adopted a resolution in favor of filling "silent squares QTH" which may appear during the contest.

For many years the USW Club has applied for the right to elect a USW manager at headquarters of PRAA. In a vote adopted by the Conference, the USW Club said it should be able to name know-how USW and microwave managers at the PRAA headquarters. The USW Club should promote the candidates to the National Congress of PRAA with suitable justifications.

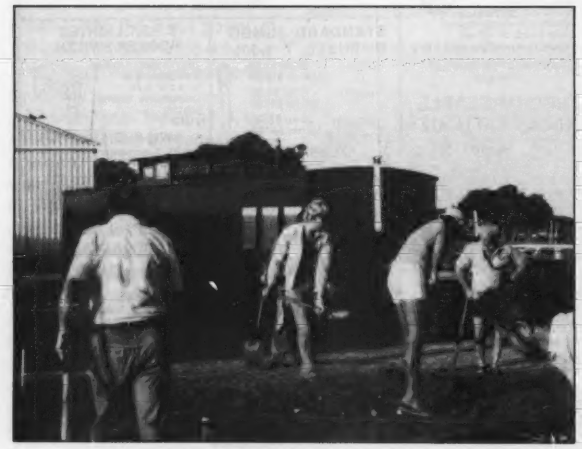
Other very important matters, relative to licenses for "portable" and "mobile" modes of work, and use of home and summer QTHs on the basis of permanent permission, were adopted by a solid vote. These new possibilities would contribute to the growth of the SW movement in Poland.

A subsequent vote insists amateurs should be granted microwave bands, using modern kinds of modulations, and transmitting computer data. The XXIV Conference of the USW Club firmly asked for a mail-order technical information center at PRAA headquarters, conforming to a resolution of the general assembly of PRAA in Chorzów.

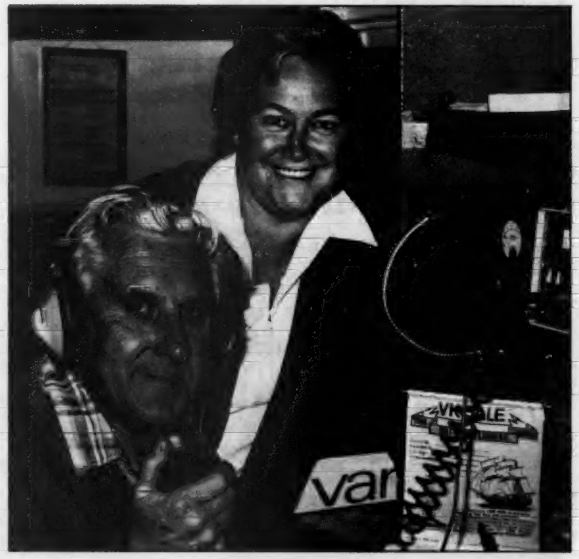
A few technical lectures were given at the Conference. A lot of interest arose about antenna problems, especially after a SP6LB lecture on antennas with vertical polarization. The president of PRAA, SP5JR, presented his research on the subject of shortwave and microwave propagation and the ground effect of their propagation.



The "grumpy old bloke from Down Under," VK3YJ.



Australia: Preparing the ground for the "new" radio room. The old one (a caboose) is in the background. (See April, 1986 column.)



Jack VK5EJ, the ex-, and Carol VK5PWA, the current president of LEPARC.

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LETTERS

from page 12

and nail to keep the ham bands totally amateur. . . .

Jim Wooddell WA6OFT
Parker AZ

Tooth and nail enough to get the FCC to say "no." Good work, guys.—Ed.

OPEN LETTER

Richard Baldwin W1RU
President, IARU

Dear Dick,

The December, 1985, issue of *QST* features a fine article, "Cruising and Amateur Radio," in your IARU news column. In addition to the pirate and unlicensed operation that was mentioned, there are several other unsavory aspects of "cruising" that should be brought to light. What we have is the erroneous belief it is not necessary to obtain "express permission" to operate amateur gear sailing or anchored in another nation's waters. The fact that our licensees aboard sailboats are most vociferous in pushing this concept rather than being passive participants is cause for alarm. After communicating with hundreds of "cruisers," I quickly learned that most of them were mainly drawn toward to the amateur spectrum because it produces a toll-free telephone communication from their yacht to any place in the world. The fact that most of this toll avoidance takes place from foreign jurisdictions certainly represents a clear and present danger to our amateur radio treaties.

If you care to observe the daily spectrum violations, please monitor 14.313 MHz or any of the many "Mickey Mouse" nets that you listed in your column. With the exception of a few Merchant Marine and military vessels, not many of the "cruisers" ever get on the air while actually out on the high seas or in true "international waters." Seldom do "cruisers" ever sail out of sight of land but rather bump along coastlines or from island to island. While sailing, use of amateur equipment is rare because there is just too much activity topside to permit ham-radio use. Most of the phone patching by "cruisers" is evident while they luxuriate in a foreign marina close to all the entertainment.

There is an urgent need for pro-amateur groups worldwide to launch a positive program of education and encouragement of legal use of amateur radio aboard sailboats. The "net junkies" and "network commanders" should receive the hard cold facts of law when they contribute to the numerous daily sovereignty violations by aiding and abetting the cruising violators with such patronizing statememnts as: "they must be underway" or "they are Mickey Mouse off Baja." The fact of the matter is that when a vessel enters a country it remains under that country's jurisdiction until the vessel is legally cleared out. Except for a few cruise ships subject to reciprocal treaty, each boat must be cleared out to a foreign destination. Many "cruisers" foster the ruse that they are "Mickey Mouse" in the Bahamas in order to allow for phone patching while they are actually domiciled on their vessels as visitors of that country. They would now have us believe that even though the boat is in Bahamian waters and their visa is in effect, that by some magic the amateur station can be instantly transported into international limbo-land by saying "we are now underway." The bottom line is that leaving a country's jurisdiction, if done legally, involves more than a mental whim. Please do what you can to place this matter before the IARU and ARRL for a consensus and appropriate action.

73.

Herbert Schoenbohm KV4FZ
Christiansted USVI

MEDIEVAL MEASURING

The comments I am about to make are inspired by articles in your magazine and, indeed, other ham-radio publications in the United States.

I am referring to the continued use of the "medieval" imperial system of measurement in construction features, antenna designs, etc. There can be no excuse for continuing this hodgepodge of measurements in electronics of all things, a science where all the units of inductance, frequency, etc., are SI ones (SI=International Standard).

Where, for example, is the logic in measuring a half-wave dipole for 40 meters in feet?

Also, amateur radio is supposed to foster communication amongst people. According to an article in the *Wall Street Journal*, there are only three countries left in the world still not officially metricated. Guess who? Burma, Brunei, and the United States.

Be progressive—educate your domestic readers. There is no way of pleasing the "imperial lobby" by the consistent use of imperial measures, even if this was considered desirable, since such measures do not exist for most electronic parameters (thank goodness). There is a way of pleasing the rest of us, with the consistent use of SI units.

Perhaps the American amateurs in their journals would care to take the initiative? Let the only feet we read about in ham-radio magazines be attached to cabinets or propping up the editor, and the only pounds be those charged when shopping in the U.K.

Ragnar Otterstad
LA5HE/OZ8RO
Holte, Denmark

MIRAGE IS REAL

How often have you purchased an item which later developed a problem and getting it fixed was an even bigger problem? Well, rejoice! There is a manufacturer who stands behind its equipment.

I was pleased with my Mirage amplifier's performance. One day, after a long-winded QSO, the power amp on a B3016 2m amp quit in a puff of smoke. The amp is used at home with a blower to keep it cool which, considering its good heat sink, is unnecessary but helpful for long key-down times.

I sent the unit, which was a couple of years old, in for repairs. Needless to say, I was surprised to have it returned promptly and with NO CHARGE marked on the invoice. I had expected a long exchange of purchase receipts, letters, charge-card info, and the like. What a nice surprise to have a warranty repair done quickly and without a quibble. I use three of their amps, two at home and one mobile, and have found them to be well made and long lasting even in the 100% duty cycle of ATV operation. I would recommend Mirage to anyone who wants a quality product.

Henry B. Ruh KB9FO
Chicago IL

ISHMOD OUTRAGE

My subscription to *73* just expired and I'm glad. I feel that I have wasted money on the last 18+ months of my multi-year subscription. I used to look forward to receiving *73* every month, but not anymore.

Almost two years ago, in the April issue, an unfinished article appeared in *73*, entitled "Ishmod's Journey," or something like that ["Ishmod's Journal," April, 1984]. It was continued to a nonexisting page. You pulled the same stunt in last April's issue (which I received a few weeks prior to April Fools' Day). There have been mentions of Ishmod in your publisher's column, praising the author. And there have been letters from readers regarding "Ishmod" with the response continued to another nonexisting page. This type of reading is not what I expected from *73* when I subscribed many years ago. I realize that change is necessary, but in my opinion, *73* has changed for the worse. These "Ishmod" articles, in my opinion, were designed as a gimmick to get readers to scrutinize every page of your magazine looking for the conclusion to the article and also provide your advertisers with more exposure than usual.

I do not get the insight into ham radio that I used to from *73*. There are fewer and fewer articles of interest to me and it seems like fewer articles in general. I do not want to go into more detail as I feel that I already wasted too much time and money on*73*.

Alan H. Carp K1HLZ
Natick MA

These "Ishmod" articles, in our opinion, were designed to give 73's readers something to chuckle over. Maybe you've forgotten, but ham radio is supposed to be fun. And if you'd bother to compare 73 with the other ham rags, you'd notice that, month after month, 73 publishes more articles. Period.—KW1O.

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MRF 455	15.00	2N6084	13.75
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PL259	10/$4.95	M358	$2.50 ea.
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UG255/u	2.50 ea.	(RG8/u)	$4.75 ea.
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PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U. S. S. R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U. S. S. R.								20	20			

WESTERN UNITED STATES TO:

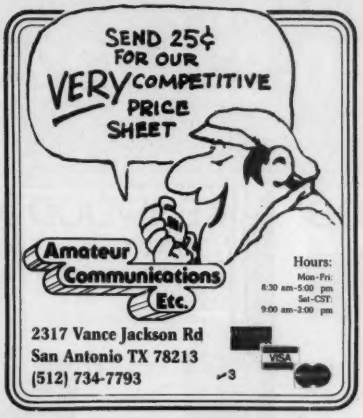
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U. S. S. R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

G=Good, F=Fair, P=Poor.

Look for some disturbances in magnetic field between 5th and 10th with possible storm levels; also possible 6- and 2-meter openings in this period. Again, between the 27th and 30th look for active magnetic field conditions and generally poor propagation on HF, LF, and VHF.

MAY

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G	3 G
4 G	5 G	6 F-P	7 P-F	8 G	9 G-F	10 F
11 G	12 G	13 G	14 G	15 G	16 G	17 G
18 G	19 G	20 F-P	21 P	22 P	23 P-F	24 F-G
25 G	26 G	27 G	28 F	29 F-P	30 P	31 F



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Sat-CST:
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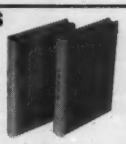

The RF Notes series of Design Aid programs can help in solving every day RF Engineering problems. Intended as inexpensive tools, these programs aid in circuit design as well as serve as a powerful source reference material.

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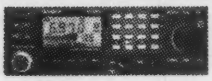

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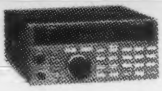

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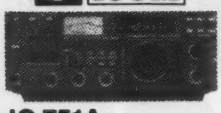

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  Covers 80-10 meters.
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- **Superior receiver dynamic range**
  Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range. (500 Hz bandwidth on 20 m)
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  Super efficient cooling permits continuous key-down for periods exceeding one hour. RF input power is rated at 200 W PEP on SSB, 200 W DC on CW, AFSK, FM, and 110 W DC AM. (The PS-50 power supply is needed for continuous duty.)
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  Subtone is memorized when TU-8 is installed.
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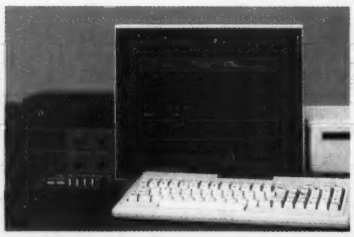
- **MC-42S UP/DOWN mic. included**
- **Computer interface port**



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